Quality Assurance Project Plan

Lower Passaic River Study Area River Mile 10.9 Characterization Addendum B Bench-Scale Testing of Sediment Treatment Technologies

Prepared for

Cooperating Parties Group, Newark, New Jersey

June 2012

CH2MHILL®

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Lower Passaic River Study Area

River Mile 10.9 Characterization Addendum B

Bench-Scale Testing of Sediment Treatment Technologies

June 2012

Revision 0

Approved By: _____ Date: June 15, 2012
Roger McCready, Project Manager/CH2M HILL

Approved By: _____ Date: June 15, 2012
Jewelle Keiser, Project QA Manager/CH2M HILL

Introduction

This document is an addendum to the *River Mile 10.9 Characterization Quality Assurance Project Plan Lower Passaic River Restoration Project*, Revision 3, dated October 21, 2011 (RM 10.9 QAPP; AECOM, 2011a). This QAPP Addendum outlines additional tasks associated with the River Mile (RM) 10.9 characterization program and provides details regarding bench-scale testing of select sediment treatment technologies to be performed using sediment collected from the RM 10.9 Removal Area located in the Lower Passaic River Study Area (LPRSA). The chemical and physical analyses to be performed during the bench-scale testing are also detailed in this addendum along with Quality Assurance (QA) and Quality Control (QC) activities developed for this program.

The bench-scale tests will be conducted using bulk sediment obtained in accordance with the *Lower Passaic River Study Area River Mile 10.9 Characterization QAPP Addendum A*, *Sediment Collection for Bench-Scale Testing of Sediment Treatment and Dewatering Technologies and for Additional Delineation*, dated May 2012 (RM 10.9 QAPP Addendum A; AECOM, 2012).

Table 1 provides a key to the RM 10.9 QAPP and this Addendum and includes the following:

- Worksheets that are included by reference as written in the RM 10.9 QAPP (i.e., not revised for this addendum and not included in this addendum);
- Worksheets that are included by reference, but with changes (e.g., addition of sediment treatment vendors or removal of specific analytes) (only changes are included in this addendum); and
- Worksheets that are revised and included in this addendum.

In addition to the QAPP worksheets, this addendum includes an introduction (this section) and an additional field Standard Operating Procedure (SOP) as an attachment (see appendices A).

Background Information

The LPRSA encompasses the 17.4-mile tidal reach of the Passaic River below the Dundee Dam, its tributaries, and the surrounding watershed that hydrologically drains below the Dundee Dam. Overall goals of the Remedial Investigation/Feasibility Study (RI/FS) and a description of the associated investigations have been presented in the Work Plan (MPI 2005a), three Field Sampling Plans (FSP1 [MPI 2006a], FSP2 [MPI 2006b], and FSP3 [MPI 2005b]), and a QAPP (MPI 2005c).

In April 2011, the Cooperating Parties Group (CPG) agreed to undertake additional sampling and data collection to characterize an approximately 8.9-acre deposit of sediments located near RM 10.9. The general scope of the characterization effort included sample collection (i.e., sediment cores) and analysis and a bathymetric survey. This work was performed in accordance with the RM 10.9 QAPP (AECOM, 2011a). In addition, a hydrodynamic study was performed in accordance with the *River Mile 10.9 Hydrodynamic Field Investigation Quality Assurance Project Plan for the Lower Passaic River, Lower Passaic River Restoration Project*, October 2011, Revision 2 (AECOM, 2011b).

As part of the RM 10.9 Administrative Order on Consent (RM 10.9 AOC; United States Environmental Protection [USEPA] June 2012), the CPG has agreed, in addition to the removal and capping of approximately 16,000 cubic yards (cy) of sediments, to collect bench-scale sediment samples that will be used to determine the efficacy and cost effectiveness of treating a portion of the RM 10.9 sediments using sediment decontamination technologies. This QAPP Addendum B documents procedures applicable to bench-scale test tests only.

General Scope of the Bench-Scale Tests

Sediment washing has been selected as the treatment technology of interest for removing site-specific constituents, which are henceforth referred to as the Group A analytes. The Group A analytes include: dibenzodioxins/polychlorinated dibenzofurans (PCDDs/PCDFs), polychlorinated biphenyls (PCBs - homologs and congeners), polycyclic aromatic hydrocarbons (PAHs), semi-volatile organic compounds (SVOCs), organochlorine pesticides, chlorinated herbicides, butyltins, Target Analyte List (TAL) metals (excluding mercury), titanium, low-level mercury, total petroleum hydrocarbon (TPH) -extractables, cyanide, total organic carbon (TOC), and grain size.. Bench-scale testing will be performed on representative samples of sediment from the RM 10.9 Removal Area, as a first step towards evaluating ex-situ treatment options for the potentially large quantities of contaminated sediments that could be generated from environmental dredging in the River. The bench-scale tests will provide the information necessary to perform a preliminary evaluation of the potential effectiveness and implementability of each technology and will also provide a basis for estimating costs for pilot-scale implementation.

Two providers of the sediment washing process will conduct bench-scale tests in their respective laboratories: (1) BioGenesis Enterprises, Inc. (BioGenesis) and (2) Pear Technology - Ground/Water Treatment & Technology, Inc. (Pear Technology).

Sediment Treatment Vendors:

Mailing Address: P.O. Box 1174 Denville, NJ 07834
Shipping Address: 627 Mount Hope Rd, Wharton, NJ 07885
(973) 983-0901
Attention: Robert Kunzel
rkunzel@gwttinc.com

BioGenesis Enterprises, Inc.
610 West Rawson Ave
Oak Creek, WI 53154
(414) 5271-6230
Attention: John Sontag, Jr. P.E.
jsontag@biogenesis.com

Brief descriptions of the two Vendor's processes are provided below:

BioGenesis Process Overview: The BioGenesis sediment washing process is a patented low temperature decontamination process, which uses impact forces and propriety chemicals to remove organic and inorganic contaminants from soil and sediment particles. The technology, which was patented by

BioGenesis in December 2001, is designed to decontaminate both coarse - grained (sand) and fine

- grained (silt and clay) particles by isolating individual particles and removing contaminants and naturally occurring organic material adsorbed to the particles. The BioGenesis process involves preprocessing, application of collision impact forces, and cavitation/oxidation, as well as several additional material handling and separation steps. Figure 1 shows the flow diagram from the BioGenesis process. The end product of the BioGenesis process is treated sediment that can potentially be put to beneficial reuse and/or disposed of at reduced cost.

The bench-scale tests proposed by BioGenesis include both jar tests and batch tests. BioGenesis will be conducting the bench-scale test in three steps:

- Jar testing: The objective of the jar tests is to finalize the chemical formulation of the wash fluid that will be most effective in removing contaminants from the RM 10.9 sediments.
- Optimization testing: The process optimization step will be conducted to finalize the unit operations (screens, mixing tanks, pumps, centrifuges, and proprietary equipment) in the treatment process. Test runs will be conducted with the formulated wash fluid to maximize the removal of contaminants from the sediments.
- Validation testing: Validation testing and sampling will be conducted in the presence of CPG representatives to evaluate the effectiveness of the sediment washing process for Group A analytes.

This QAPP addendum covers the third step in BioGenesis' bench testing process, validation testing. Data generated during the preliminary steps leading up to the validation testing are for internal vendor use only. These data will not be used to evaluate the effectiveness of the process as their purpose is to finalize formulation of washing chemicals and optimize the unit processes. Only data generated during the validation testing will be used to evaluate the sediment washing process and therefore this is the only step covered by QAPP Addendum B.

Pear Technology Process Overview: The bench-scale tests proposed by Pear Technology include jar tests. The jar tests are being conducted to identify the chemicals (including wash solution, coagulants, and flocculants) needed to remove the contaminants from the untreated sediment and subsequently to determine whether sediment washing is feasible for Group A analytes in the RM 10.9 sediments. Summarized below, and presented in Figure 2, is the unit processes employed in the Pear Technology sediment washing process:

- Screening/Separation system that separates debris such as brick, wood, plastics, etc. Screening will be performed in the laboratory using a standard coarse soil sieve.
- Mixing tank system that adds chemicals while providing rigorous mixing. Mixing will be accomplished during bench-scale testing using standard gang stirrer system. The use of the gang stirrer will also allow for testing of a variety of wash chemicals under controlled conditions. A variety of soil/water proportions will also be tested to determine the optimum wash mixing results.
- Clarification system that allows for the removal of sediment. Clarification will be accomplished by settling within the beakers and decanting the water.
- Second clarification system to remove the fines that pass the initial clarification system using coagulants and flocculants. This additional clarification will be accomplished in a gang stirrer.
- High energy pump and mixing chamber to further enhance chemical contact with the individual sediment particles. A small suitably sized centrifugal pump and mix chamber will be utilized.
- Belt or plate and frame press to remove the remaining fines. This will not be performed in the bench-scale test but the sediment will be collected, dried and tested as required.

Bench-Scale Test Objectives

The primary objective of the bench-scale tests is to determine the technical efficacy and cost-effectiveness of the sediment washing process for removing Group A analytes from the RM 10.9 sediments. Information obtained from the bench-scale tests will also be used to evaluate the cost effectiveness of employing the sediment washing process at the pilot/full scale.

Sampling and Analysis Approach

As discussed earlier, the bench-scale tests can be conducted in the form of jar tests, batch tests with prototype equipment, or a combination of jar tests and batch tests. The bench-scale tests proposed by BioGenesis include both jar tests and batch tests using scaled-down (1/12 of pilot scale) equipment. Samples for evaluation of the bench-scale test will be collected during the batch testing phase of the BioGenesis process; samples will not be collected during the jar testing phase. The bench-scale tests proposed by Pear Technology include only jar tests and therefore process evaluation will be completed with samples collected during the jar tests.

The sampling activities to be performed during the bench-scale tests will include collection of untreated sediment, treated sediment, and waste water generated during the soil washing process (Figures 1 and 2). Sediment samples will be analyzed for the RM 10.9 Group A analytes and waste water will be analyzed for select discharge to surface water permit equivalent analytes. Duplicate samples will be collected for QA/QC from both the untreated sediment and waste water holding tank at one vendor (Biogenesis). BioGenesis has agreed to host a CPG representative during the bench-scale testing to observe the process and to collect samples. Pear Technology indicated that they intend to collect samples on behalf of the CPG, but will not be hosting a CPG representative during the bench-scale testing.

Figure 1: BioGenesis Bench-Scale Testing Process Diagram and Proposed Sample Locations

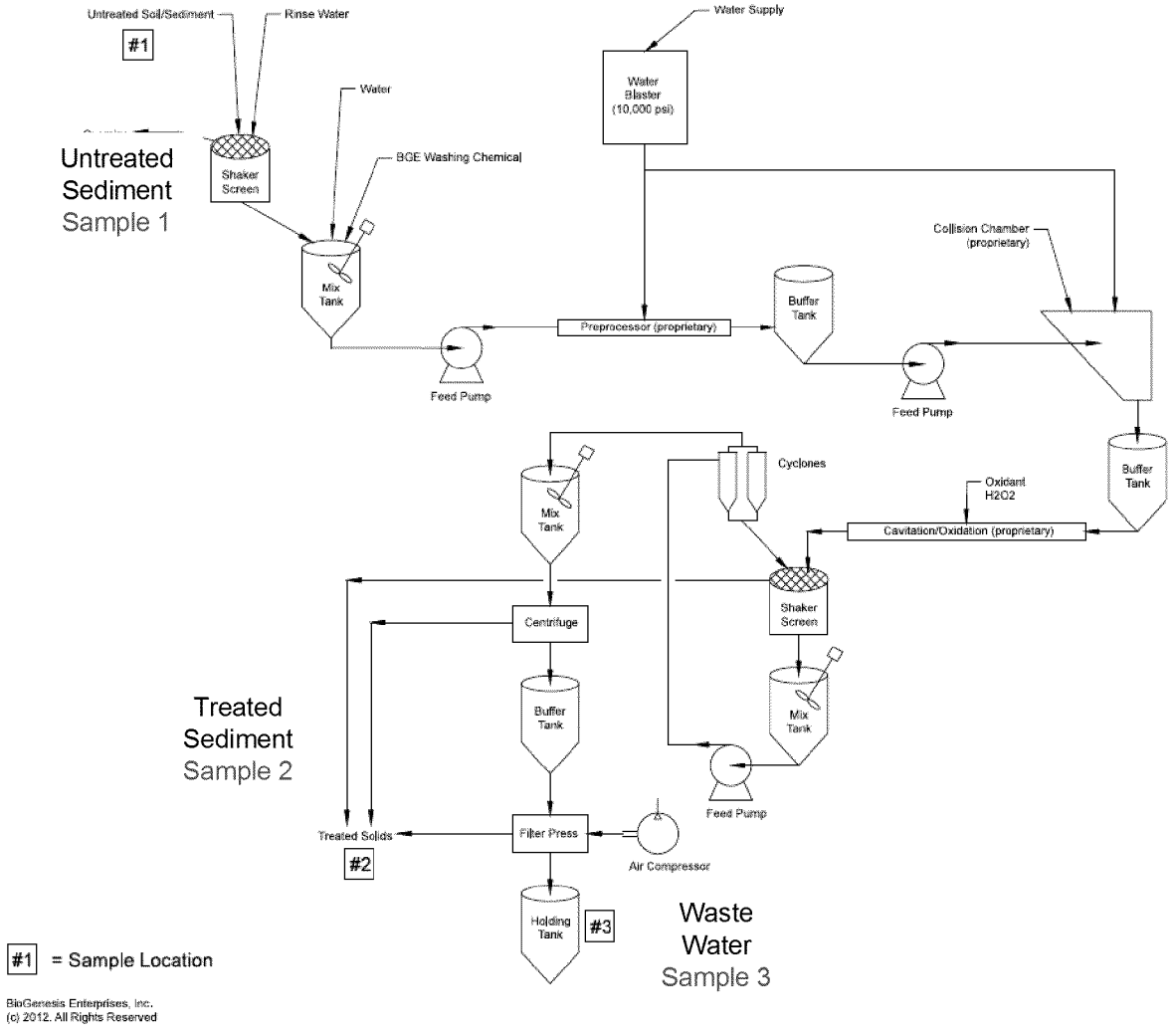
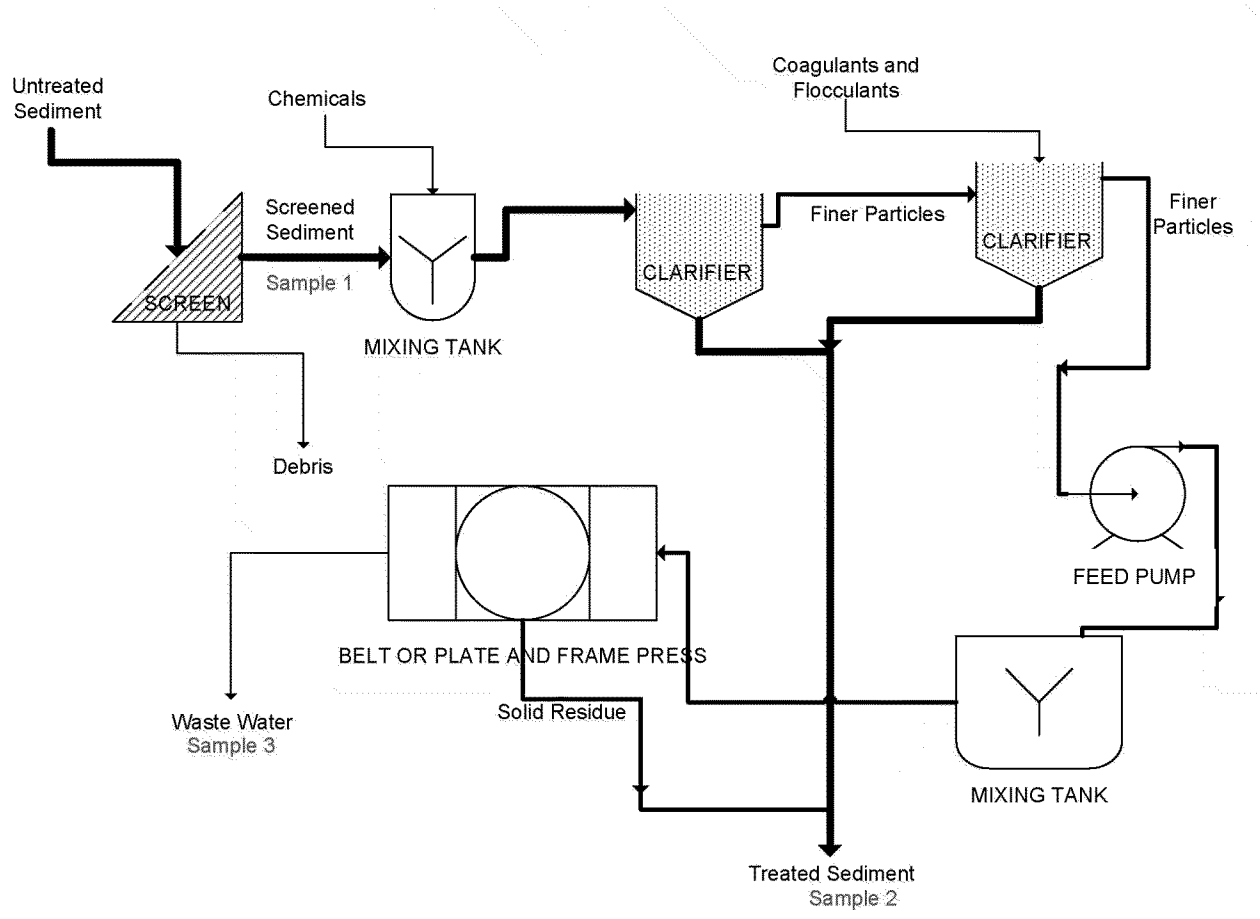


Figure 2: Pear Technology Bench-Scale Testing Process Diagram and Proposed Sample Locations



Worksheet No.	Worksheet Title	RM 10.9 QAPP Worksheets			RM 10.9 QAPP Addendum B Worksheet
		No Changes	Changes - Additions	Changes - Exclusions	
1	Title and Approval Page				Replacement
2	QAPP Identifying Information		Updated to reflect Addendum B scoping session and to add RM 10.9 QAPP Addendum A to list of documents		Replacement
3	Distribution List		Added CH2M HILL RM 10.9 Addendum B Task Manager, CH2M HILL Project Manager, and sediment treatment vendors		Changes only
4	Project Personnel Sign-Off Sheet		Added CH2M HILL RM 10.9 Addendum B Task Manager, CH2M HILL Project Manager, and sediment treatment vendors		Changes only
5	Project Organizational Chart				Replacement
6	Communication Pathways		Added CH2M HILL RM 10.9 Addendum B Task Manager, CH2M HILL Project Manager, and sediment treatment vendors		Replacement
7	Personnel Responsibilities and Qualifications Table		Added CH2M HILL RM 10.9 Addendum B Task Manager, CH2M HILL Project Manager, and sediment treatment vendors		Replacement
8	Special Personnel Training Requirements Table	Not applicable for Addendum B			
9	Project Scoping Session Participants Sheet		Added Addendum B Scoping Sessions		Changes Only
10	Problem Definition				Replacement
11	Project Quality Objectives/Systematic Planning Process Statements				Replacement

12	Measurement Performance Criteria Table		Information for aqueous samples added		Changes Only
13	Secondary Data Criteria and Limitations Table	X			See RM 10.9 QAPP Worksheet
14	Summary of Project Tasks				Replacement
15	Reference Limits and Evaluation Table		Information for aqueous samples added		Changes Only
16	Project Schedule/Timeline Table				Replacement
17	Sampling Design and Rationale				Replacement
18	Sampling Locations and Methods/SOP Requirements Table				Replacement
19	Analytical SOP Requirements Table		Information for aqueous samples added		Changes Only
20	Field Quality Control Sample Summary Table	Not applicable for Addendum B			
21	Project Sampling SOP Reference Table		Added bench scale testing sample collection SOP		Changes Only
22	Field Equipment				Replacement
23	Analytical SOP Reference Table		Analytical Perspectives PCDD/PCDF SOP modification for a minimum 5 g aliquot. Information for aqueous samples added		Changes Only
24	Analytical Instrument Calibration Table		Information for aqueous samples added		Changes Only
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table		Information for aqueous samples added		Changes Only
26	Sample Handling System		Revisions to reflect collection, shipping and handling by treatment technology vendors		See Appendix A SOP for Bench Scale Testing

27	Sample Custody Requirements		Added sample nomenclature for bench-scale testing samples		Changes only
28	QC Samples Table		Information for aqueous samples added		Changes only
29	Project Documents and Records Table	X			see RM 10.9 QAPP Worksheet
30	Analytical Services Table		Information for aqueous samples added		Changes only
31	Planned Project Assessment Table			Safety and technical audits and PE samples not applicable	see RM 10.9 QAPP Worksheet
32	Assessment Findings and Response Actions			Safety and technical audits and PE samples not applicable	see RM 10.9 QAPP Worksheet
33	QA Management Reports Table	X			see RM 10.9 QAPP Worksheet
34	Sampling and Analysis Verification (Step I) Process Table	X			see RM 10.9 QAPP Worksheet
35	Sampling and Analysis Validation (Steps IIa and IIb) Process Table		Updated validation steps added		Replacement
36	Sampling and Analysis Validation (Steps IIa and IIb) Summary Table	X			see RM 10.9 QAPP Worksheet
37	Data Usability Assessment				Replacement

QAPP Worksheet #1 (UFP-QAPP Manual Section 2.1) Title and Approval Page

Document Title: Lower Passaic River Study Area, River Mile 10.9 Characterization Addendum B – Bench-Scale Testing of Sediment Treatment Technologies

Lead Organization: CPG and de maximis, inc.

Preparer's Name and Organizational Affiliation: Jennifer Wilkie, CH2M HILL

Preparer's Address and Telephone Number: 8735 W. Higgins Road, Suite 400, Chicago, IL 60631.

Ph: 773-458-2830

Preparation Date (Day/Month/Year): June 15, 2012

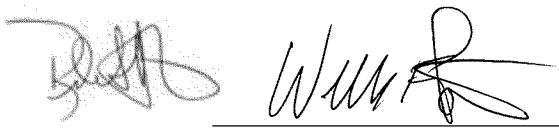
Investigative Organization's Project Manager

Roger McCready/CH2M HILL / June 2012

Investigative Organization's Project Quality Assurance (QA) Manager

Jewelle Keiser /CH2M HILL / June 2012

Lead Organization's Project Manager



Willard Potter/Robert Law / de maximis, inc/June 2012

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Site Name/Project Name:	**Diamond Alkali Operable Unit (OU 2) – LPRRP RI/FS**
Site Location:	**Lower Passaic River Study Area (LPRSA), New Jersey**
Site Number/Code :	**CERCLA Document No. 02-2007-2009**
Operable Unit:	**OU 2**
Contractor Name:	**CH2M HILL**
Contractor Number:	**Not Applicable (N/A)**
Contract Title:	**N/A**
Work Assignment Number:	**N/A**

1. Identify guidance used to prepare QAPP:

   Uniform Federal Policy for Quality Assurance Project Plans. Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final Version 1. March 2005. Intergovernmental Data Quality Task Force (US Environmental Protection Agency, US Department of Defense, US Department of Energy). USEPA 505-B-04-900A.

2. Identify regulatory program: Comprehensive Environmental Response Compensation, and Liability Act (CERCLA)

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a generic or a project-specific QAPP. (circle one)

5. List dates of scoping sessions that were held: May 12 and 19 and June 8, 2011 (RM 10.9 QAPP); and March 28 and 29, 2012 (RM 10.9 Addendum B).

6. List dates and titles of QAPP and FSP documents written for previous site work, if applicable:

Title
CLH 1995. *Work Plan, Vol. 1 of Passaic River Study Area Remedial Investigation Work Plans*. Chemical Land Holdings (now Tierra Solutions, Inc.), Newark, NJ. January 1995.
Tierra Solutions, Inc. 1999. *Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan*. March 1999.
MPI 2005. *Lower Passaic River Restoration Project. Quality Assurance Project Plan.* Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2006. *Lower Passaic River Restoration Project. Field Sampling Plan*. Volume 1. Prepared for US Environmental Protection Agency, US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2007. *QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation*. December 2007.
ENSR 2008. *Lower Passaic River Restoration Project RI/FS. Quality Assurance Project Plan. RI Low Resolution Coring/Sediment Sampling*. Revision 4. ENSR, Westford, MA. October 2008.

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Windward 2009a. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA. August 2009.
Windward 2009b. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA. October 2009.
AECOM 2010a. *Lower Passaic River Restoration Project: Periodic Bathymetric Surveys. Quality Assurance Project Plan*. Revision 2. AECOM, Westford, MA. May 2010.
AECOM 2010b. *Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring. Lower Passaic River Restoration Project.* Revision 4. AECOM, Westford, MA. March 2010. Referred to herein as the AECOM 2010 Water Column Monitoring QAPP.
Tierra Solutions, Inc. 2010c. *Combined Sewer Overflow/Stormwater Outfall Investigation Quality Assurance Project Plan. Lower Passaic River Study Area*. Revision 0. July 2010.
AECOM 2011a, *Lower Passaic River Study Area River Mile 10.9 Characterization Quality Assurance Project Plan*. Revision 3. Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. October 2011.
AECOM, 2011b. *River Mile 10.9 Hydrodynamic Field Investigation Quality Assurance Project Plan for the Lower Passaic River, Lower Passaic River Restoration Project*, October 2011, Revision 2.
AECOM 2012a, *Lower Passaic River Study Area, River Mile 10.9 Characterization Addendum A. Sediment Collection for Bench-Scale Testing of Sediment Treatment and Dewatering Technologies and for Additional Delineation*. Prepared for Cooperating Parties Group, Newark, New Jersey. AECOM, Chelmsford, MA. May 2012.
AECOM 2012b. *Remedial Investigation Water Column Monitoring/High Volume Chemical Data Collection QAPP*, Rev. 0, May 2012.

7. List organizational partners (stakeholders) and connection with lead organization:

   This work will be performed under the requirements of the Settlement Agreement and SOW for the Lower Passaic River Study Area portion of the Diamond Alkali Superfund Site with oversight by USEPA and its government partners (e.g., NJDEP). Conducting the work on behalf of the CPG are de maximis, inc. (acting as Project Coordinator for the CPG) and CH2M HILL and its subcontractors.

8. List data users: See item #7 above.

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table.
   Provide an explanation for their exclusion below: Worksheets 8 and 20 are not applicable to Addendum B. Refer Table 1 in the Introduction section.

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 NA
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps	9 9 10 and Introduction
2.6 Project Quality Objectives (PQOs) and Measurement Performance Criteria 2.6.1 Development of PQOs Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	14 15 16
Measurement/Data Acquisition		

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field QC Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17 Figures 1 and 2 18 19 NA Appendix A 21 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Appendix C of the RM 10.9 QAPP and Appendix C of the Water Column Monitoring QAPP 23 24 25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation - Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow - Example Chain-of-Custody Form and Seal	26 and Appendix A Appendix A 27 27 Appendix A
3.4 QC Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	- QC Samples Table	28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management Procedures	29 30 Data Management Plan (DMP) (AECOM 2010c)
Assessment/Oversight		

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Planned Project Assessments Table - Assessment Findings and Corrective Action Responses Table	31 32
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report	To be completed following data collection	37
Data Review		
5.1 Overview 5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	To be completed following data evaluation	

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

The following persons will receive a copy of the approved Final QAPP, subsequent QAPP revisions, addenda, and amendments:

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Roger McCready	Project Manager	CH2M HILL	937.220.2961	Roger.McCready@ch2m.com	
Jennifer Wilkie	RM 10.9 Characterization QAPP Addendum B Task Manager	CH2M HILL	773.458.2830	Jennifer.Wilkie@ch2m.com	
Robert Kunzel	Sediment Treatment Vendor	Pear Technology	973.983.0901	rkunzel@gwttinc.com	
John Sontag, Jr., P.E.	Sediment Treatment Vendor	BioGenesis Enterprises, Inc.	414.571.6230	jsontag@biogenesis.com	

*Uncontrolled electronic copies will be available on www.ourpassaic.org

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

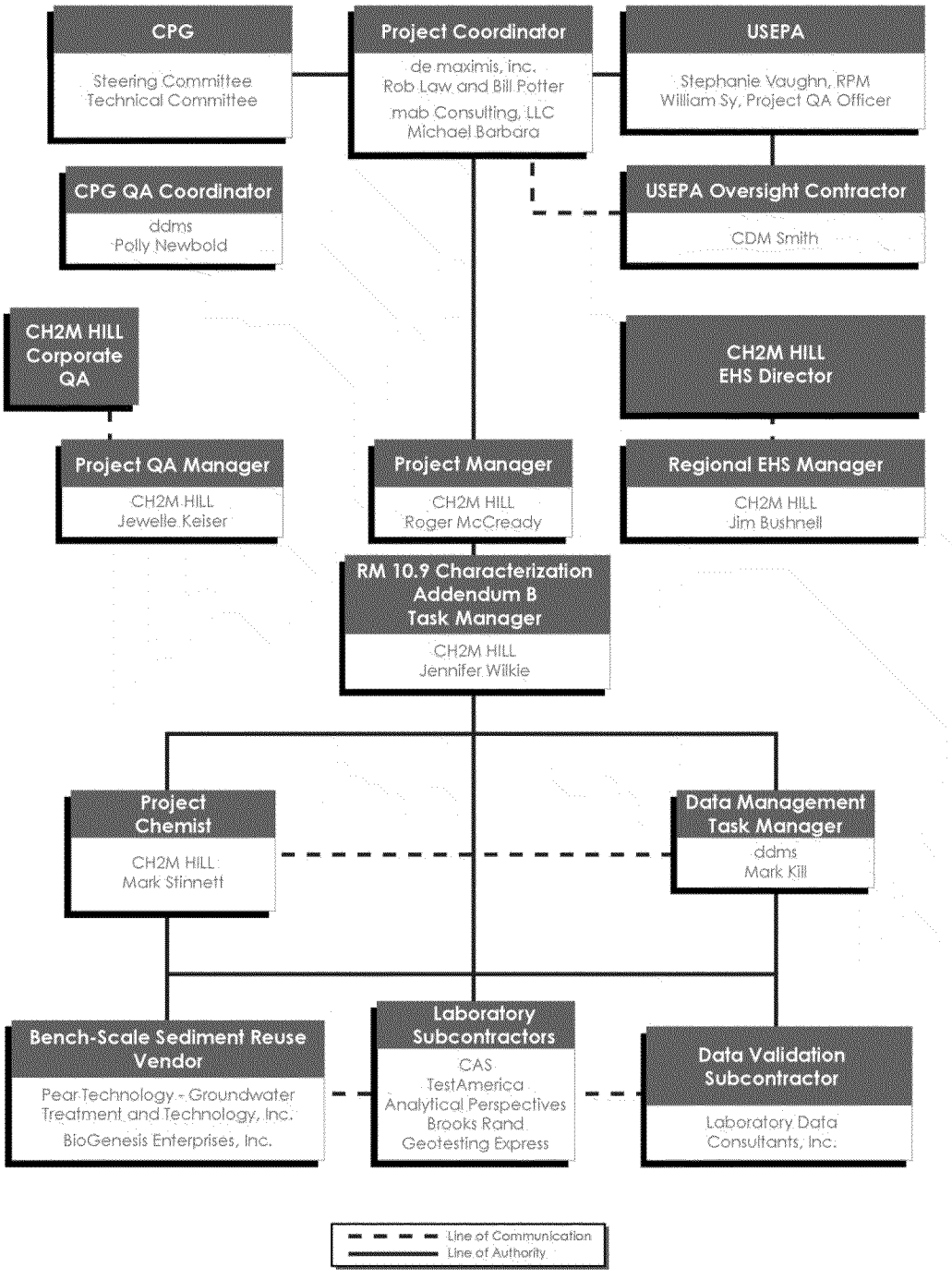
QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

Organization: A completed sign-off sheet will be maintained in the files for each organization represented below.

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read
Roger McCready	Project Manager	937.220.2961		
Jennifer Wilkie	RM 10.9 Characterization QAPP Addendum B Task Manager	773.458.2830		
Robert Kunzel	Sediment Treatment Vendor	973.983.0901		
John Sontag, Jr., P.E.	Sediment Treatment Vendor	414.571.6230		

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

QAPP Worksheet #5 (UFP-QAPP Manual Section 2.4.1) Project Organizational Chart



QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathway

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Field activities (bench-scale testing) status and issues	CH2M HILL Task Manager	Jennifer Wilkie	773.458.2830 Cell 224.659.9101	Communicate, as needed, with CH2M HILL PM, subcontractors, and CH2M HILL project team directly, or via e-mail or phone. Minor work plan deviations and/or proposed revisions will be documented and communicated in writing, with a copy sent to USEPA.
Sampling progress/laboratory coordination	CH2M HILL Task Manager	Jennifer Wilkie	773.458.2830 Cell 224.659.9101	Communicate as needed with CH2M HILL Project Chemist via e-mail or phone.
Health and safety briefings and updates	CH2M HILL Task Manager	Jennifer Wilkie	773.458.2830 Cell 224.659.9101	Communicate, as needed, with field personnel and vendors directly, or via e-mail or phone.
Significant health and safety concerns or incidents	CH2M HILL Task Manager	Jennifer Wilkie	773.458.2830 Cell 224.659.9101	Communicate immediately with CH2M HILL Regional EHS Manager, CH2M HILL PM.
Analytical laboratory issues, including coordination with bench scale testing, schedule, and technical issues	CH2M HILL Project Chemist	Mark Stinnett	678.530.4378	Communicate with Laboratory PM as needed via phone or e-mail.
Analytical data validation issues	CH2M HILL Data Validation Coordinator	Mark Stinnett	678.530.4378	Communicate with CH2M HILL PM, CH2M HILL Task Manager, and Laboratory PM as needed via phone or e-mail.
Issues potentially affecting DQOs	CH2M HILL Task Manager	Jennifer Wilkie	773.458.2830 Cell 224.659.9101	Communicate with CH2M HILL QA Manager and CH2M HILL PM as needed, via e-mail or phone. Notification of the CPG QA Coordinator as appropriate. Significant work plan modifications will be reported to USEPA in writing prior to implementation.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathway

	ddms Data Management Task Manager	Mark Kill	651.842.4232	
	CH2M HILL Project Chemist	Mark Stinnett	678.530.4378	
Bench-Scale Treatability Study task status and issues	Pear Technology - Ground/Water Treatment & Technology, Inc.	Robert Kunzel	973.983.0901	Communicate with CH2M HILL Task Manager, as needed, to coordinate sampling for bench-scale testing.
	BioGenesis Enterprises, Inc.	John Sontag	414.521.6230	
Project status and issues (internal)	CH2M HILL Project Manager	Roger McCready	937.220.2961	Communicate with CPG Project Coordinator, as needed, via email or phone, and submit monthly progress reports.
Project status and issues (external)	CPG Project Coordinator	Willard Potter/ Robert Law (de maximis, inc.) Mike Barbara (mab.Consulting, LLC)	908.735.9315	Communicate with USEPA RPM as needed via e-mail or phone.
	CPG Coordinating Counsel	William Hyatt / Dawn Monsen (K&L Gates)	973.848.4045 or 4148	In the event the CPG Project Coordinator is unavailable for communication with USEPA, the CH2M HILL PM will notify the Coordinating Counsel prior to contacting USEPA.
Quality status and issues	CPG QA Coordinator	Polly Newbold	908.479.1975	Communicate with CPG Project Coordinator as needed via email or telephone
Data management	CH2M HILL Task Manager	Jennifer Wilkie	773.458.2830 Cell 224.659.9101	Communicate with the Data Management Task Manager via email; transmit final field locations and sample collection information daily.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathway

	ddms Data Management Task Manager	Mark Kill	651.842.4232	Maintain comprehensive project technical database, communicate with CH2M HILL Task Manager to receive data from the bench-scale testing; communicate with Laboratory PM(s) to receive analytical result data, communicate with CH2M HILL Task Manager to provide data for review; and provide data deliverables to USEPA.
	Laboratory PM	See Worksheet #7	See Worksheet #7	Transmit Electronic Data Deliverables (EDDs) to Data Management Task Manager.

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Robert Law	CPG Project Coordinator (Lead)	de maximis, inc.	Overall responsibility for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project quality assurance/quality control (QA/QC), and Health and Safety including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	PhD, Geology, 26 years experience
Willard Potter	CPG Project Coordinator (Alternate)	de maximis, inc.	Serves as back up for the Lead CPG Project Coordinator. Responsible for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project QA/QC, and Health and Safety including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	BS, Chemical Engineering, 36 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Roger McCready	CH2M HILL	CH2M HILL	Overall responsibility for technical oversight of FS tasks in accordance with SOW requirements including technical, financial, and scheduling. Primary point of contact for CH2M HILL with CPG Project Coordinator.	MS, Geology, 24 years experience
Mike Barbara	Principal	mab.consulting LLC	Project oversight and coordination with the CPG Coordinator.	ME, Environmental Engineering, BE, Civil Engineering, 37 years experience
Jennifer Wilkie	Task Manager	CH2M HILL	Responsible for the execution and completion of the bench-scale testing of sediment treatment technologies under the RM 10.9 Characterization program, including procurement of subcontractors, review of task deliverables, and serving as the focus for coordination of all field and laboratory tasks. The CH2M HILL Task Manager will keep the CH2M HILL PM apprised of the status of the task; as well communicate any issues with the schedule, budget, or achievement of the task objectives. Responsible for implementing field sampling activities in accordance with the approved plans QAPP, HASP) and pertinent SOPs. Primary responsibilities will include directing activities on site, monitoring subcontractor performance in the field, reviewing field records, and communicating daily with the CH2M HILL PM regarding status, quality issues, or delays.	PhD, Civil and Environmental Engineering, BS and MS, Chemical Engineering, 15 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Jewelle Keiser	Project QA Manager	CH2M HILL	Responsible for reviewing and approving QA procedures, ensuring that planned QA assessments (e.g., data validation) are conducted according to this QAPP Addendum and reporting on the adequacy of the QA Program to the CH2M HILL PM.	MS, Geology and Geophysics/ Hydrogeology, BS, Geology, 28 years experience
Jim Bushnell	Regional EHS Manager	CH2M HILL	Responsible for ensuring that the objectives of CH2M HILL's Health and Safety Program are met and for monitoring task activities for conformance to the HASP.	BS, Chemical Engineering, 30 years experience
Mark Stinnett	Project Chemist and Data Validation Coordinator	CH2M HILL	Responsible for laboratory procurement and monitoring of progress and will be the primary point of contact with the laboratory(ies). The Project Chemist will also be responsible for communicating any issues that could affect achievement of the DQOs to the CH2M HILL Task Manager and the CH2M HILL Project QA Manager. Responsible for managing the validation task, including ensuring that validation is conducted and documented according to the requirements of this QAPP, and interacting with the laboratories to resolve any issues.	BS, Chemistry, 28 years experience
Mark Kill	Data Management Task Manager	ddms, inc.	Responsible for data management for project, Including overall responsibility for database quality and structure, including graphical representation of data.	BA, Geography, 13 years experience
Polly Newbold	CPG QA Coordinator	ddms, inc.	Provides oversight of project QA/QC. Periodically review and audit operations to ensure that QAPP/FSP Addendum QA/QC procedures are being followed.	BS, Textile Science, 26 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

John Reynolds	Laboratory PM	Test America	Acts as the primary point of contact at Test America facilities for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all Test America network laboratories.	BS, Biology, 16 years experience
Lynda Huckestein	Laboratory PM	Columbia Analytical Services (CAS)	Acts as the primary point of contact at CAS facilities for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all CAS network laboratories.	BS, Microbiology, 22 years experience
Misty Kennard-Mayer	Laboratory PM	Brooks Rand, LLC	Acts as the primary point of contact at Brooks Rand, LLC for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Environmental Science, 7 years experience
Todd Vilen	Laboratory PM	Analytical Perspectives	Acts as the primary point of contact at Analytical Perspectives for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BA, Chemistry, BS, Aquatic Biology, 24 years experience
Gary Torosian	Laboratory PM	GeoTesting Express	Acts as the primary point of contact at GeoTesting Express for the CH2M HILL Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Civil Engineering, 20 years experience
Robert Kunzel	Bench-scale Treatability Vendor PM	Pear Technology - Ground/Water Treatment & Technology, Inc.	Acts as the primary point of contact at Pear Technology - Ground/Water Treatment & Technology, Inc.; communicates bench-scale testing of sediment treatment technologies issues to the CH2M HILL Project Manger.	Environmental Professional, 30 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

John Sontag	Bench-scale Treatability Vendor PM	BioGenesis Enterprises, Inc.	Acts as the primary point of contact at BioGenesis Enterprises, Inc. for the CH2M HILL Project Manager to communicate bench-scale testing of sediment treatment technologies issues.	Environmental Professional, 15 years experience

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI River Mile 10.9 Characterization Addendum B - Bench-Scale Testing of Sediment Treatment Technologies **Projected Date(s) of Sampling: May 2012** **Project Manager: Willard Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA; RM 10.9**

Date of Session: March 28, 2012

Scoping Session Purpose: Discussion between CH2M HILL and BioGenesis concerning scope of bench-scale testing of sediment treatment technology.

Name	Affiliation	Phone #	E-mail Address	Project Role
Roger McCready	CH2M HILL	937.220.2961	Roger.McCready@ch2m.com	CPG Technical Consultant
Jennifer Wilkie	CH2M HILL	773.458.2830	Jennifer.Wilkie@ch2m.com	CPG Technical Consultant
Devamita Chattopadhyay	CH2M HILL	937.220.2959	Devamita.Chattopadhyay@ch2m.com	CPG Technical Consultant
John Sontag	BioGenesis	414.521.6230	jsontag@biogenesis.com	BioGenesis Project Manager

Comments/Decisions: Discussed the scope of the bench-scale test and the applicability of the treatment technology for the LPRSA. BioGenesis will receive bulk sediments from a portion of the RM 10.9 Removal Area for the bench-scale treatment.

Date of Session: March 29, 2012

Scoping Session Purpose: Discussion between CH2M HILL and Pear Technology concerning scope of bench-scale testing of sediment treatment technology.

Name	Affiliation	Phone #	E-mail Address	Project Role
Roger McCready	CH2M HILL	937.220.2961	Roger.McCready@ch2m.com	CPG Technical Consultant
Jennifer Wilkie	CH2M HILL	773.458.2830	Jennifer.Wilkie@ch2m.com	CPG Technical Consultant
Devamita Chattopadhyay	CH2M HILL	937.220.2959	Devamita.Chattopadhyay@ch2m.com	CPG Technical Consultant
Robert Kunzel	Pear Technology	973.983.0901	rkunzel@gwttinc.com	Pear Technology Project Manager

Comments/Decisions: Discussed the scope of the bench-scale test and the applicability of the treatment technology for the LPRSA. Pear Technology will receive bulk sediments from a portion of the RM 10.9 Removal Area for the bench-scale treatment.

QAPP Worksheet #10 (UFP-QAPP Manual Section 2.5.2) Problem Definition

The problem to be addressed by the RM 10.9 QAPP Addendum B:

Bench-scale testing is needed as a first step in determining the overall technical efficacy and cost-effectiveness of using sediment washing as a treatment technology for the pilot-scale treatment of RM 10.9 sediments contaminated with elevated concentrations of Group A analytes. The bench-scale results will also be used in USEPA's revised Focused Feasibility Study and the LPRSA Feasibility Study to determine the technical feasibility and cost-effectiveness of treating contaminated sediments from the LPRSA.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

DQO Step	**RM 10.9 QAPP Addendum B Data Quality Objective (DQO): Determine the technical efficacy of the selected sediment treatment technologies during bench-scale testing.** **Description**
STEP 1 **State the problem**	Data are needed to evaluate if the sediment treatment technology can effectively treat Group A analytes.
STEP 2 **Identify the goals of the study**	**Principal Study Questions** 1. Will the selected sediment treatment technology provide a technically feasible, implementable, and cost-effective solution to the handling of the sediments in LPRSA? 2. Will the treated sediment quality satisfy New Jersey Department of Environmental Protection (NJDEP) soil cleanup criteria for residential use and 1,000 parts per trillion (ppt) total dioxin toxicity equivalents (TEQ)? 3. Will the selected treatment technology reduce the cost of disposal of the impacted sediment? **Program Goals** The goal of the bench-scale testing is to identify a suitable treatment technology to treat LPRSA sediments, and more specifically the sediments from the RM 10.9 Removal Area. With this objective, bench-scale tests are being proposed to determine the technical efficacy and cost-effectiveness of the sediment washing process, for removing site-specific Group A analytes from the RM 10.9 sediments. Bench-scale tests will be conducted using bulk sediment samples collected from areas with elevated Group A analytes within the RM 10.9 Removal Area. Addendum A of the RM 10.9 QAPP Addendum A (AECOM 2012) details the collection of bulk sediment that will be used as the feed material for the bench-scale studies. **Alternative Actions** The following alternative actions could result from resolution of the principal study questions: • Evaluate alternative methods of treating RM 10.9 Removal Area sediment. **Decision Statements on Collection of Representative Samples During the Bench-Scale Tests** • If the sediment washing process is found to be both technically and cost-effective and at the bench-scale level, continued testing at the pilot scale will be implemented if the overall project schedule permits. • If the sediment washing process is not found to be technically and cost-effective at the bench-scale level,

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

	or the overall project schedule does not permit then alternative disposal options will be considered.
STEP 3 **Identify the information inputs**	Information required to answer the decision statement will include data to be obtained from the treatment process, as summarized below. **New Data Needed** Untreated sediment sample will be collected for laboratory analyses prior to the bench-scale treatment process. Approximately 500 grams (g) of sediment will be collected and placed into laboratory provided containers. A similar amount of sample of the composited treated sediment will also be to determine the efficiency of the process. In general, Group A analytes removed from the sediment are partitioned into the aqueous phase. Approximately three gallons (gal) of waste water will be collected and placed into laboratory provided containers for analysis. **Existing Data** 1. CH2MHILL and AECOM, April 2012. Draft River Mile 10.9 Characterization Program Summary, Lower Passaic River Study Area. **Existing Reports** 1. AECOM, 2011. Draft Low Resolution Coring Characterization Summary. Lower Passaic River Study Area RI/FS. 2. CH2MHILL and AECOM, 2012. Draft River Mile 10.9 Characterization Program Summary, Lower Passaic River Study Area.
STEP 4 **Define the boundaries of the study**	**Geographic Area** Sediment for the bench-scale tests were obtained from the RM 10.9 Removal Area, which is located within the RM 10.9 sediment deposit from approximately RM 10.8 to RM 11.1 and includes the mudflat and point bar in the east half of the river channel (See Figure 1 of RM 10.9 QAPP Addendum A). The bulk sediment samples were composited, divided and transported to the sediment treatment vendors. The bench-scale tests will be conducted in the laboratories of the vendors. **Timeframe** Bench-scale tests will be completed within 90 days of notification to proceed.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

	Sample Type During the bench-scale tests, both sediment and water samples will be collected. Samples will include an untreated sediment sample, a treated sediment sample, and a waste water sample, from each vendor. As shown in Figures 1 and 2, treated sediment is generated at multiple points, during a single run of the sediment washing process. The processes will be run only once. These sediments will be composited before shipment to the laboratories to ensure sufficient sample volume is available for determination of Group A analyte concentrations in the treated sediment.
STEP 5 **Develop the analytical approach**	**Approach for Collecting Samples** All samples will be collected directly into the laboratory provided sample containers. No post sampling processing will occur with the exception of treated sediment, which will be composited. In order to evaluate the technical efficacy of the selected treatment processes, untreated and treated sediment samples will be collected for laboratory analyses. These samples will be analyzed using the same methods, and by the same laboratories, as specified in the RM 10.9 QAPP. Wastewater generated during the sediment treatment process will also be collected and sent to the laboratories for analysis of select analytes associated with the discharge to surface water permit equivalent granted for the Phase I Removal Action adjacent to the Diamond Alkali Superfund Site along Harrison Reach of the Lower Passaic River. These samples will be analyzed using the same methods, and by the same laboratories, as specified in the *Remedial Investigation Water Column Monitoring/High Volume Chemical Data Collection QAPP*, Rev. 0, May 2012. Residual sediment at the end of the bench-scale study will be returned to the CPG field facility and disposed as investigation-derived waste (IDW). Waste water will be handled by the Vendors. **Anticipated Analytical Methods for Sediment** The following is the list of Group A analytes and the corresponding analytical methods for the untreated sediment: • PCDDs/PCDFs using EPA Method 1613B • PCBs (homologs and congeners) using EPA Method 1668A • PAHs using a laboratory-specific SOP based on California EPA Air Resources Board Method 429 and NOAA ORCA 130 Method

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

	SVOCs using EPA Method 8270C • Organochlorine pesticides using a laboratory-specific SOP based on USEPA Method 1699 • Chlorinated herbicides using EPA Method 8151A • TPHs (extractable) using NJDEP Method OQA-QAM-025-02/08 • Butyltins using a laboratory-specific SOP based on Krone 1988 • TAL metals (excluding mercury) and titanium using EPA Method 6010C/6020A • Mercury, low-level using EPA Method 1631 • Cyanide using EPA Method 335.2 • TOC using the Lloyd Kahn Method • Grain size using ASTM D 422 The following is the list of analytes and the corresponding analytical methods for the <u>treated sediment</u>: • All Group A analytes listed for untreated sediment • TCLP SVOCs using EPA Methods 1311/8270C • TCLP pesticides using EPA Methods 1311/8081 • TCLP herbicides using EPA Methods 1311/8151A • TCLP mercury using EPA method 1311/7470/7471 • TCLP metals using EPA method 1311/6010 **<u>Anticipated Analytical Methods for Waste Water</u>** The following is the list of analytes and the corresponding analytical methods for the waste water: • PCDDs/PCDFs using EPA Method 1613B • PCBs (homologs and congeners) using EPA Method 1668A • PAHs using a laboratory-specific SOP based on California EPA Air Resources Board Method 429 and NOAA ORCA 130 Method • VOCs using EPA Method 8260B

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

	SVOCs using EPA Method 8270C • Pesticides using Method EPA 1699 • Herbicides using Method EPA 8151A • TAL metals (excluding mercury) using EPA Method 6010C/6020A • Mercury (low-level) using EPA Method 1631 • Cyanide using Method 335.4/SW846-9012A • Total dissolved solids (TDS) using SM2540C • Suspended sediment concentration (SSC) using ASTM D3977 • TOC using SW846-9060 **Project Quantification Limits** The reporting limits for sediment are included in RM 10.9 QAPP Worksheet #15. The reporting limits for wastewater samples are included in this QAPP Addendum B as Worksheet #15. **Quality Assurance/Quality Control Program (QA/QC)** QA/QC samples (field and method blanks, field and laboratory duplicates, and laboratory control samples) will be analyzed with the sediment and waste water samples for appropriate analytical tests. RM 10.9 QAPP Worksheets #12 and #28 and RM 10.9 QAPP Addendum B Worksheets #12 and 28 provide performance criteria of the precision and accuracy measurements. Data verification and validation protocols are detailed in RM 10.9 QAPP Worksheets #34, 35, 36, and 37 and RM 10.9 QAPP Addendum B Worksheets #35 and 37. **Anticipated Data Evaluations** The analytical data for the treated sediment will be compared with those of the untreated sediment to estimate the percent removal of each of the analytes. The analytical data for the treated sediment will be compared to NJDEP soil cleanup criteria for residential use and the dioxin criterion of 1,000 ppt TEQ to evaluate beneficial reuse options for the treated sediment. Waste water will be compared to applicable/potential publically owned treatment works (POTW) permit levels and New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water Permit Equivalents.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

STEP 6 **Specify performance or acceptance criteria**	Uncertainty is always present in the measurement and interpretation of environmental data. In this case, the focus is on collecting and interpreting data to understand the applicability and efficiency of the sediment treatment processes. In the absence of defined decision tolerance limits, the sampling design should still strive to identify possible sources of error and minimize them, to the extent practical. Both random and systematic errors can be introduced during the physical collection of the sample, sample handling, sample analysis, and data handling. Errors introduced through these steps will be controlled by preparing and following SOPs and establishing appropriate controls for data quality. These controls apply to laboratory analytical errors (e.g., calibration standard, internal standard, surrogate recoveries, and laboratory control sample), and data validation. The RM 10.9 QAPP worksheets provide further detail on error control procedures. Appendix C of the RM 10.9 QAPP (Laboratory SOPs) and SOPs attached to this addendum provide supporting details. This investigation is meant to provide the data to evaluate select sediment treatment processes. By reducing the errors associated with testing sample collection, handling, analysis, and reporting with the strict adherence and use of standardized and documented procedures, as well as the noting of deviations from these procedures, the induced variability of the data set is minimized and the data set is a better representation of the processes studied.
STEP 7 **Develop the detailed plan for obtaining data**	**<u>Evaluation of Sediment Treatment Technology during Bench-Scale Testing</u>** *BioGenesis Process Sampling*: Three samples and two duplicates will be collected during the bench-scale test. These include a sample of the untreated sediment, a sample of the composited treated sediment, and waste water from the holding tank. Duplicate samples for QA/QC will be collected from the untreated sediment and the waste water holding tank. *Pear Technology Sampling*: Three samples will be collected during the bench-scale test. These include a sample of the untreated sediment, a sample of the composited treated sediment, and waste water from the holding tank.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	VOCs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-1, C-2	Accuracy/Bias-Contamination	No target compound >Quantitation Limit (QL), no common lab contaminants >5x QL	Method Blank (MB)/Instrument Blank	A
	C-1, C-2	Accuracy/Bias-Contamination	No target compound >QL, no common lab contaminants >5x QL	Trip Blank	S & A
	C-1, C-2	Accuracy/Bias	Compound-specific percent recoveries (%Rs), see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP.)	Laboratory Control Sample (LCS)	A
	C-1, C-2	Accuracy/Bias	1,2-Dichloroethane-d4: 59-127%R 4-Bromofluorobenzene: 68-117%R Dibromofluoromethane: 73-122%R Toluene-d8: 78-129%R	Surrogates	A
	C-1, C-2	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL.	Field Duplicate	S & A
	C-1, C-2	Completeness (Laboratory Analyses)	≥ 90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	SVOCSs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-2, T-7	Accuracy/Bias-Contamination	No target compound >QL, no common lab contaminants >5x QL	MB/Instrument Blank	A
	T-2, T-7	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP.	LCS	A
	T-2, T-7	Accuracy/Bias	2-Fluorobiphenyl: 19-107%R 2-Fluorophenol: 10-111%R 2,4,6-Tribromophenol: 16-122%R Nitrobenzene-d5: 23-112%R Phenol-d5: 15-112%R Terphenyl-d14: 10-132%R	Surrogates	A
	T-2, T-7	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	T-2, T-7	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-2, T-7	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PAHs and Alkyl PAHs (Low Resolution Mass Spectrometry [LRMS] – SIM)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-4, T-3	Accuracy/Bias-Contamination	No target compound >QL	MB/Instrument Blank	A
	T-4, T-3	Accuracy/Bias	60-140%R	LCS	A
	T-4, T-3	Accuracy/Bias	60-140%R in MB and LCS 30-120%R in field samples	Labeled compounds	A
	T-4, T-3	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	T-4, T-3	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-4, T-3	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	OC Pesticides				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-11	Accuracy/Bias - Contamination	No target compound >QL	MB/Instrument Blank	A
	T-11	Accuracy/Bias	50-120%R, except for 4,4'-DDD 24-123%; 2,4'-DDE 24-123%; Endrin Aldehyde 50-170%; Endrin Ketone 50-134%;	On-going Precision and Recovery (OPR) sample (equivalent to LCS sample)	A
	T-11	Accuracy/Bias	Per EPA 1699 Table 5	Labeled compounds	A
	T-11	Accuracy/Bias	Supplier Certified Limits	QCCS Sample Analysis[d]	A
	T-11	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-11	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PCBs – Congeners and Homologs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-6, T-5	Accuracy/Bias- Contamination	No target compound > QL	MB/Instrument Blank	A
	T-6, T-5	Accuracy/Bias	50-150%R Toxics/Level of Chlorination (LOC) congeners 40-160%R all other congeners	OPR sample (equivalent to LCS)	A
	T-6, T-5	Accuracy/Bias	30-140%R	Labeled compounds	A
	T-6, T-5	Accuracy/Bias	Supplier Certified Limits	QCCS Sample Analysis[d]	A
	T-6, T-5	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-6, T-5	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PCDD/PCDFs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/ SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	A-1	Accuracy/Bias-Contamination	No target compound >QL	MB/Instrument Blank	A
	A-1	Accuracy/Bias	%D for RRF vs ICAL ≤ 20% except labeled analogs ≤ 30%	Batch control spike (BCS_3)[d]	A
	A-1	Accuracy/Bias	Compound-specific %Rs, see SOP	Labeled Compounds	A
	A-1	Accuracy/Bias	Supplier Certified Limits	QCCS Sample Analysis	A
	A-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	A-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP
[d] The BCS_3 is a special QC sample prepared with each 20 sample batch that combines all the spike solutions used on field samples with target analytes. It is analyzed at the beginning and end of each analytical sequence containing the associated samples.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Herbicides (GC/ECD)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQIs**	**Measurement Performance Criteria**[d]	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	TA-13, TA-15	Accuracy/Bias-Contamination	No target compound >QL	Method Blank/Instrument Blank	A
	TA-13, TA-15	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP.	LCS	A
	TA-13, TA-15	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S & A
	TA-13, TA-15	Completeness	≥ 90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP
[d] Analyte specific limits may be found in Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Metals (total) by Inductively Coupled Plasma/ Atomic Emission Spectroscopy (ICP/AES)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-4, C-3	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-4, C-3	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP.	LCS	A
	C-4, C-3	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	C-4, C-3	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-4, C-3	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-4, C-3	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Metals (total) by Inductively Coupled Plasma – Mass Spectrometry (ICP/MS)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-3, C-5	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-3, C-5	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP.	LCS	A
	C-3, C-5	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	C-3, C-5	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-3, C-5	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-3, C-5	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Mercury (Low Level, total)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	B-1	Accuracy/Bias-Contamination	Average MB <2x Method Detection Limit (MDL) and standard deviation <0.67x MDL or <0.1x the concentration of project samples	MB	A
	B-1	Accuracy/Bias	80 -120%R	LCS	A
	B-1	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	B-1	Precision	RPD ≤24%	Laboratory Duplicate	A
	B-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	B-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – TDS				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-19	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-19	Accuracy/Bias	85-115%R	LCS	A
	C-19	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	C-19	Precision	RPD ≤10%	Laboratory Duplicate	A
	C-19	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-19	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Cyanide				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-10	Accuracy/Bias-Contamination	No detection >QL	MB	A
	C-10	Accuracy/Bias	83 – 116%R	LCS	A
	C-10	Accuracy/Bias	Supplier Certified Limits	Sample Analysis	A
	C-10	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-10	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-10	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – SSC				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-17	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-17	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-17	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-17	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry –TOC				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-13, C-16	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-13, C-16	Accuracy/Bias	90-109%R	LCS	A
	C-13, C-16	Precision	RPD≤ 20%	LCS Duplicate (LCSD)	A
	C-13, C-16	Accuracy/Bias	≤110% of the unspiked sample	Inorganic Carbon Spike	A
	C-13, C-16	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-13, C-16	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Sampling Tasks: Samples will be collected during the bench-scale tests to determine the applicability and efficiency of the sediment treatment processes. During the bench-scale tests, both sediment and water samples will be collected in bottles/jars supplied by the analytical laboratory. Samples will include an untreated sediment sample, a treated sediment sample, and a waste water sample. The treated sediment sample will be a composited sample.

Analysis Tasks: The untreated sediment will be analyzed for Group A analytes: PCDDs/PCDFs, PCBs (homologs and congeners), PAHs, SVOCs, organochlorine pesticides, herbicides, butyltins, Target Analyte List (TAL) metals (excluding mercury), titanium, low-level mercury, TPH-Extractables, cyanide, TOC, and grain size. The treated sediment will be analyzed for the following parameters: all Group A analytes listed for untreated sediment, TCLP SVOCs, TCLP pesticides, TCLP herbicides, TCLP mercury, and TCLP metals. The waste water samples will be analyzed for the following analytes: PCDDs/PCDFs, PCBs (homologs and congeners), PAHs, VOCs, SVOCs, organochlorine pesticides, herbicides, TAL metals (excluding mercury), low-level mercury, cyanide in addition to TDS, SSC, and TOC.

Secondary Data: All relevant secondary/historical data are summarized on RM 10.9 QAPP Worksheet #13 and RM 10.9 QAPP Addendum C Worksheet #13.

Data Management Tasks: The Data Management Plan (AECOM 2010c in RM 10.9 QAPP) covers all laboratory-generated records/data and data collected during the bench-scale tests. The handling of records and data are summarized on RM 10.9 QAPP Worksheet #29.

Documentation and Records: Project related records (field, sample transfer/chain of custody, laboratory) are summarized on RM 10.9 QAPP Worksheet #29.

Assessment/Audit Tasks: Field and laboratory audits specific to the RM 10.9 QAPP Addendum will not be conducted during this program.

Data Review Tasks: Bench-scale test data will be reviewed as described in RM 10.9 QAPP Worksheet #34. Laboratories are contractually required to verify all laboratory data including EDDs as summarized in RM 10.9 QAPP Worksheet #34. Data validation and usability assessments will be conducted as detailed in RM 10.9 QAPP Worksheets #35, and 36, and RM 10.9 QAPP Addendum B Worksheet #37.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: TCL VOCs
Concentration Level: Low

Analyte	CAS Number	Project QL[b] (µg/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
			MDLs	Method QLs	MDLs	QLs
1,1,1-Trichloroethane	71556	0.5	NA	5	0.08	0.5
1,1,2,2-Tetrachloroethane	79345	0.5	NA	5	**0.16**	**0.5**
1,2,2-Trichloro-1,1,2-trifluoroethane	76131	0.5	NA	5	0.13	0.5
1,1,2-Trichloroethane	79005	0.5	NA	5	**0.14**	**0.5**
1,1-Dichloroethene	75354	0.5	NA	5	0.077	0.5
1,1-Dichloroethane	75343	0.5	NA	5	0.074	0.5
1,2,3-Trichlorobenzene	87616	2	NA	5	0.11	2
1,2,4-Trichlorobenzene	120821	2	NA	5	0.096	**2**
1,2-Dibromoethane	106934	2	NA	5	**0.2**	**2**
1,2-Dibromo-3-chloropropane	96128	2	NA	5	**0.1**	**2**
1,2-Dichlorobenzene	95501	0.5	NA	5	0.12	0.5
1,2-Dichloroethane	107062	0.5	NA	5	0.08	**0.5**
1,2-Dichloropropane	78875	0.5	NA	5	0.095	**0.5**
1,3-Dichlorobenzene	541731	0.5	NA	5	0.1	0.5
1,4-Dichlorobenzene	106467	0.5	NA	5	0.12	**0.5**
2-Butanone	78933	20	NA	5	1.9	20
2-Hexanone	591786	20	NA	5	2.7	**20**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

4-Methyl-2-pentanone	108101	20	NA	5	2.6	20
Acetone	67641	20	NA	5	3.3	20
Benzene	71432	0.5	NA	5	0.054	**0.5**
Bromochloromethane	74975	0.5	NA	5	0.16	0.5
Bromodichloromethane	75274	0.5	NA	5	0.091	**0.5**
Bromoform	75252	0.5	NA	5	0.16	0.5
Bromomethane	74839	0.5	NA	5	0.09	0.5
Carbon disulfide	75150	0.5	NA	5	0.055	0.5
Carbon tetrachloride	56235	0.5	NA	5	0.096	**0.5**
Chlorobenzene	108907	0.5	NA	5	0.11	0.5
Chloroethane	75003	0.5	NA	5	0.16	0.5
Chloroform	67663	0.5	NA	5	0.072	**0.5**
Chloromethane	74873	0.5	NA	5	0.068	0.5
cis-1,2-Dichloroethene	156592	0.5	NA	5	0.067	0.5
cis-1,3-Dichloropropene	10061015	0.5	NA	5	0.18	**0.5**
Cyclohexane	110827	1	NA	5	0.1	1
Dibromochloromethane	124481	0.5	NA	5	0.14	**0.5**
Dichorodifluoromethane	75718	0.5	NA	5	0.13	0.5
Ethylbenzene	100414	0.5	NA	5	0.05	0.5
Isopropylbenzene	98828	2	NA	5	0.051	2
Methyl acetate	79209	1	NA	5	0.15	1
Methyl tert-Butyl Ether						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	1634044					
Methylcyclohexane	108872	1	NA	5	0.086	1
Methylene chloride	75092	2	NA	5	0.1	2
Styrene	100425	0.5	NA	5	0.089	0.5
Tetrachloroethene	127184	0.5	NA	5	0.099	**0.5**
Toluene	108883	0.5	NA	5	0.052	0.5
trans-1,2-Dichloroethene	156605	0.5	NA	5	0.057	0.5
trans-1,3-Dichloropropene	10061026	0.5	NA	5	0.068	**0.5**
Trichloroethene	79016	0.5	NA	5	0.1	0.5
Trichlorofluoromethane	75694	0.5	NA	5	0.12	0.5
Vinyl chloride	75014	0.5	NA	5	**0.075**	**0.5**
Xylenes (total)	1330207	0.5	NA	5	0.09	0.5
Tentatively Identified Compounds	NA	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: TCL SVOCs
Concentration Level: Low

Analyte	CAS Number	Project QL[b] (µg/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e,g]	
			MDLs	Method QLs	MDLs	QLs
1,1'-Biphenyl	92524	1	NA	10	0.04	**1**
1,2,4,5-Tetrachlorobenzene	95943	1	NA	10	0.07	**1**
1,4-Dioxane by modified EPA Method 8270 SIM	123911	0.2	NA	10	0.14	**2**
2,3,4,6-Tetrachlorophenol	58902	1	NA	10	0.14	1
2,4,5-Trichlorophenol	95954	1	NA	10	0.15	1
2,4,6-Trichlorophenol	88062	1	NA	10	0.18	**1**
2,4-Dichlorophenol	120832	0.2	NA	10	0.03	0.2
2,4-Dimethylphenol	105679	1	NA	10	0.09	1
2,4-Dinitrophenol	51285	5	NA	50	0.61	5
2,4-Dinitrotoluene	121142	1	NA	10	0.05	**1**
2,6-Dinitrotoluene	606202	1	NA	10	0.08	1
2-Chloronaphthalene	91587	0.2	NA	10	0.02	0.2
2-Chlorophenol	95578	1	NA	10	0.17	1
2-Methylnaphthalene	91576	0.2	NA	10	0.01	0.2
2-Methylphenol	95487	1	NA	10	0.09	1
2-Nitroaniline	88744	5	NA	50	0.35	5

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

2-Nitrophenol	88755	1	NA	10	0.17	1
3,3',-Dichlorobenzidine	91941	1	NA	20	**0.11**	**1**
3-Nitroaniline	99092	5	NA	50	0.32	5
4,6-Dinitro-2-methylphenol	534521	5	NA	50	0.22	**5**
4-Bromophenyl phenylether	101553	1	NA	10	0.06	1
4-Chloro-3-methylphenol	59507	1	NA	10	0.08	1
4-Chloroaniline	106478	1	NA	20	0.09	**1**
4-Chlorophenyl phenylether	7005723	1	NA	10	0.05	1
4-Methylphenol	106445	1	NA	10	0.09	1
4-Nitroaniline	100016	5	NA	50	0.02	**5**
4-Nitrophenol	100027	5	NA	50	0.17	5
Acenaphthene	83329	0.2	NA	10	0.01	0.2
Acenaphthylene	208968	0.2	NA	10	0.02	0.2
Acetophenone	98862	1	NA	10	0.08	1
Anthracene	120127	0.2	NA	10	0.02	0.2
Atrazine	1912249	1	NA	10	0.09	**1**
Benzaldehyde	100527	1	NA	10	0.15	1
Benzo(g,h,i)perylene	191242	0.2	NA	10	0.02	0.2
Benzo(a)pyrene	50328	0.2	NA	10	**0.01**	**0.2**
Benzo(a)anthracene	56553	0.2	NA	10	**0.01**	**0.2**
Benzo(b)fluoranthene	205992	0.2	NA	10	**0.02**	**0.2**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Benzo(k)fluoranthene	207089	0.2	NA	10	**0.05**	**0.2**
bis-(2-Chloroethoxy) methane	111911	1	NA	10	0.06	1
bis-(2-Chloroethyl)ether	111444	0.2	NA	10	**0.03**	**0.2**
2,2'-Oxybis (1-chloropropane)	108601	0.2	NA	10	0.02	0.2
bis(2-Ethylhexyl)phthalate	117817	0.2	NA	10	0.80	0.2
Butylbenzylphthalate	85687	1	NA	10	0.14	1
Caprolactam	105602	1	NA	10	1.19	1
Carbazole	86748	5	NA	10	0.02	5
Chrysene	218019	0.2	NA	10	**0.01**	**0.2**
Dibenzo(a,h)anthracene	53703	0.2	NA	10	**0.02**	**0.2**
Dibenzofuran	132649	1	NA	10	0.06	1
Diethylphthalate	84662	1	NA	10	0.15	1
Dimethylphthalate	131113	1	NA	10	0.08	1
Di-n-Butylphthalate	84742	1	NA	10	0.13	1
Di-n-octylphthalate	117840	1	NA	10	0.21	1
Fluoranthene	206440	0.2	NA	10	0.02	0.2
Fluorene	86737	0.2	NA	10	0.02	0.2
Hexachlorobenzene	118741	0.2	NA	10	**0.02**	**0.2**
Hexachlorobutadiene	87683	0.2	NA	10	0.02	0.2
Hexchlorocyclopentadiene	77474	1	NA	10	0.05	1
Hexachloroethane	67721	1	NA	10	0.06	1
Indeno(1,2,3-cd)pyrene						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	193395					
Isophorone	78591	1	NA	10	0.06	1
Naphthalene	91203	0.2	NA	10	0.01	**0.2**
Nitrobenzene	98953	0.2	NA	10	0.08	**0.2**
N-Nitroso-di-n-propylamine	621647	0.2	NA	10	**0.03**	**0.2**
n-Nitrosodiphenylamine	86306	0.2	NA	10	0.09	0.2
Pentachlorophenol	87865	1	NA	50	0.07	**1**
Phenanthrene	85018	0.2	NA	10	0.04	0.2
Phenol	108952	0.2	NA	10	0.06	0.2
Pyrene	129000	0.2	NA	10	0.06	0.2
Tentatively Identified Compounds	NA	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PCB Congeners and Homologs
Concentration Level: Low

Analyte	CAS Number	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
			MDLs	Method QLs	EDLs	QLs
PCB 1	2051-60-7	40	NA	200	6.73	40
PCB 2	2051-61-8	40	NA	10	4.18	40
PCB 3	2051-62-9	40	NA	200	6.44	40
PCB 4	13029-08-8	60	NA	500	10.40	60
PCB 5	16605-91-7	40	NA	50	4.60	40
PCB 6	25569-80-6	40	NA	50	6.62	40
PCB 7	33284-50-3	40	NA	50	3.85	40
PCB 8	34883-43-7	60	NA	500	8.61	60
PCB 9	34883-39-1	40	NA	50	4.60	40
PCB 10	33146-45-1	40	NA	50	7.35	40
PCB 11	2050-67-1	60	NA	200	36.37	60
PCB 12	2974-92-7	60	NA	100	20.40	60
PCB 13	2974-90-5	60	NA	100	20.40	60
PCB 14	34883-41-5	40	NA	100	5.78	40
PCB 15	2050-68-2	40	NA	500	10.81	40
PCB 16	38444-78-9	40	NA	100	8.57	40
PCB 17	37680-66-3	40	NA	200	10.95	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

PCB 18	37680-65-2	60	NA	500	11.45	60
PCB 19	38444-73-4	40	NA	100	9.67	40
PCB 20	38444-84-7	40	NA	500	16.62	40
PCB 21	55702-46-0	40	NA	200	12.64	40
PCB 22	38444-85-8	40	NA	200	9.92	40
PCB 23	55720-44-0	40	NA	200	3.16	40
PCB 24	55702-45-9	40	NA	200	11.22	40
PCB 25	55712-37-3	40	NA	200	7.67	40
PCB 26	38444-81-4	40	NA	200	9.05	40
PCB 27	38444-76-7	40	NA	200	5.63	40
PCB 28	7012-37-5	40	NA	500	16.62	40
PCB 29	15862-07-4	40	NA	200	9.05	40
PCB 30	35693-92-6	60	NA	500	11.45	60
PCB 31	16606-02-3	40	NA	500	10.12	40
PCB 32	38444-77-8	40	NA	200	5.67	40
PCB 33	38444-86-9	40	NA	200	12.64	40
PCB 34	37680-68-5	40	NA	200	3.38	40
PCB 35	37680-69-6	40	NA	200	9.58	40
PCB 36	38444-87-0	40	NA	200	7.49	40
PCB 37	38444-90-5	40	NA	500	8.96	40
PCB 38	53555-66-1	40	NA	200	4.65	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

PCB 39	38444-88-1	40	NA	200	7.33	40
PCB 40	38444-93-8	40	NA	500	6.45	40
PCB 41	52663-59-9	40	NA	500	6.45	40
PCB 42	36559-22-5	40	NA	200	4.04	40
PCB 43	70362-46-8	40	NA	200	9.35	40
PCB 44	41464-39-5	40	NA	500	10.67	40
PCB 45	70362-45-7	40	NA	200	12.06	40
PCB 46	41464-47-5	40	NA	200	2.62	40
PCB 47	2437-79-8	40	NA	500	10.67	40
PCB 48	70362-47-9	40	NA	200	2.55	40
PCB 49	41464-40-8	40	NA	500	8.53	40
PCB 50	62796-65-0	40	NA	200	9.16	40
PCB 51	68194-04-7	40	NA	200	12.06	40
PCB 52	35693-99-3	40	NA	500	7.50	40
PBB 53	41464419	40	NA	500	9.16	40
PCB 54	15968-05-5	40	NA	500	4.69	40
PCB 55	74338-24-2	40	NA	500	6.13	40
PCB 56	41464-43-1	40	NA	200	4.97	40
PCB 57	70424-67-8	40	NA	500	4.62	40
PCB 58	41464-49-7	40	NA	500	2.76	40
PCB 59	74472-33-6	40	NA	200	11.65	40
PCB 60						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	33025-41-1					
PCB 61	33284-53-6	40	NA	500	23.80	40
PCB 62	54230-22-7	40	NA	200	11.65	40
PCB 63	74472-34-7	40	NA	500	4.77	40
PCB 64	52663-58-8	40	NA	200	4.99	40
PCB 65	33284-54-7	40	NA	500	10.67	40
PCB 66	32598-10-0	40	NA	500	12.05	40
PCB 67	73575-53-8	40	NA	500	5.69	40
PCB 68	73575-52-7	40	NA	500	3.86	40
PCB 69	60233-24-1	40	NA	500	8.53	40
PCB 70	32598-11-1	40	NA	500	23.80	40
PCB 71	41464-46-4	40	NA	500	6.45	40
PCB 72	41464-42-0	40	NA	500	3.67	40
PCB 73	74338-23-1	40	NA	500	9.35	40
PCB 74	32690-93-0	40	NA	500	23.80	40
PCB 75	32598-12-2	40	NA	500	11.65	40
PCB 76	70362-48-0	40	NA	500	23.80	40
PCB 77	32598-13-3	40	NA	500	4.36	40
PCB 78	70362-49-1	40	NA	500	4.43	40
PCB 79	41464-48-6	40	NA	500	3.15	40
PCB 80	33284-52-5	40	NA	500	3.59	40
PCB 81	70362-50-4	40	NA	500	3.41	**40**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

PCB 82	52663-62-4	40	NA	500	8.29	40
PCB 83	60145-20-2	40	NA	500	9.28	40
PCB 84	52663-60-2	40	NA	500	5.97	40
PCB 85	65510-45-4	40	NA	500	8.37	40
PCB 86	55312-69-1	40	NA	500	10.46	40
PCB 87	38380-02-8	40	NA	500	10.46	40
PCB 88	55215-17-3	40	NA	500	7.37	40
PCB 89	73575-57-2	40	NA	500	5.57	40
PCB 90	68194-07-0	40	NA	500	4.70	40
PCB 91	68194-05-8	40	NA	500	7.37	40
PCB 92	52663-61-3	40	NA	500	3.67	40
PCB 93	73575-56-1	40	NA	500	7.55	40
PCB 94	73575-55-0	40	NA	500	4.51	40
PCB 95	38379-99-6	40	NA	500	6.75	40
PCB 96	73575-54-9	40	NA	500	2.64	40
PCB 97	41464-51-1	40	NA	500	10.46	40
PCB 98	60233-25-2	40	NA	500	12.09	40
PCB 99	38380-01-7	40	NA	500	17.70	40
PCB 100	39485-83-1	40	NA	500	7.55	40
PCB 101	37680-73-2	40	NA	1000	4.70	40
PCB 102	68194-06-9	40	NA	500	12.09	40
PCB 103						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	60145-21-3					
PCB 104	56558-16-8	40	NA	500	5.75	40
PCB 105	32598-14-4	40	NA	200	4.45	40
PCB 106	70424-69-0	40	NA	500	5.80	40
PCB 107	70424-68-9	40	NA	200	3.72	40
PCB 108	70362-41-3	40	NA	1000	22.86	40
PCB 109	74472-35-8	40	NA	500	10.46	40
PCB 110	38380-03-9	40	NA	1000	7.25	40
PCB 111	39635-32-0	40	NA	1000	3.43	40
PCB 112	74472-36-9	40	NA	1000	17.70	40
PCB 113	68194-10-5	40	NA	1000	4.70	40
PCB 114	74472-37-0	40	NA	500	4.67	40
PCB 115	74472-38-1	40	NA	1000	7.25	40
PCB 116	18259-05-7	40	NA	200	8.37	40
PCB 117	68194-11-6	40	NA	200	8.37	40
PCB 118	31508-00-6	40	NA	500	6.27	40
PCB 119	56558-17-9	40	NA	500	10.46	40
PCB 120	68194-12-7	40	NA	500	3.45	40
PCB 121	56558-18-0	40	NA	500	3.45	40
PCB 122	76842-07-4	40	NA	500	4.58	40
PCB 123	65510-44-3	40	NA	500	5.04	40
PCB 124	70424-70-3	40	NA	1000	22.86	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

PCB 125	74472-39-2	40	NA	500	10.46	40
PCB 126	57465-28-8	40	NA	500	**2.16**	**40**
PCB 127	39635-33-1	40	NA	1000	6.56	40
PCB 128	38380-07-3	40	NA	500	10.78	40
PCB 129	55215-18-4	40	NA	500	8.91	40
PCB 130	52663-66-8	40	NA	500	8.69	40
PCB 131	61798-70-7	40	NA	500	1.27	40
PCB 132	38380-05-1	40	NA	500	4.62	40
PCB 133	35694-04-3	40	NA	500	2.67	40
PCB 134	52704-70-8	40	NA	500	10.43	40
PCB 135	52744-13-5	40	NA	500	6.28	40
PCB 136	38411-22-2	40	NA	200	3.36	40
PCB 137	35694-06-5	40	NA	1000	3.50	40
PCB 138	35065-28-2	40	NA	500	8.91	40
PCB 139	56030-56-9	40	NA	500	4.37	40
PCB 140	59291-64-4	40	NA	500	4.37	40
PCB 141	52712-04-6	40	NA	200	3.77	40
PCB 142	41411-61-4	40	NA	1000	4.40	40
PCB 143	68194-15-0	40	NA	500	10.43	40
PCB 144	68194-14-9	40	NA	500	5.50	40
PCB 145	74472-40-5	40	NA	1000	3.12	40
PCB 146						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	51908-16-8					
PCB 147	68194-13-8	40	NA	500	4.52	40
PCB 148	74472-41-6	40	NA	1000	5.00	40
PCB 149	38380-04-0	40	NA	1000	4.52	40
PCB 150	68194-08-1	40	NA	1000	3.41	40
PCB 151	52663-63-5	40	NA	500	6.28	40
PCB 152	68194-09-2	40	NA	1000	2.30	40
PCB 153	35065-27-1	40	NA	500	7.11	40
PCB 154	60145-22-4	40	NA	500	4.88	40
PCB 155	33979-03-2	40	NA	1000	3.16	40
PCB 156	38380-08-4	40	NA	500	4.48	40
PCB 157	69782-90-7	40	NA	500	4.48	40
PCB 158	74472-42-7	40	NA	200	2.46	40
PCB 159	39635-35-3	40	NA	1000	3.38	40
PCB 160	41411-62-5	40	NA	500	7.22	40
PCB 161	74472-43-8	40	NA	1000	2.62	40
PCB 162	39635-34-2	40	NA	1000	4.07	40
PCB 163	74472-44-9	40	NA	500	8.91	40
PCB 164	74472-45-0	40	NA	500	3.50	40
PCB 165	74472-46-1	40	NA	1000	4.06	40
PCB 166	41411-63-6	40	NA	500	10.78	40
PCB 167	52663-72-6	40	NA	500	4.96	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

PCB 168	59291-65-5	40	NA	500	7.11	40
PCB 169	32774-16-6	40	NA	500	**3.63**	**40**
PCB 170	35065-30-6	40	NA	500	2.91	40
PCB 171	52663-71-5	40	NA	1000	7.80	40
PCB 172	52663-74-8	40	NA	1000	3.37	40
PCB 173	68194-16-1	40	NA	1000	7.80	40
PCB 174	38411-25-5	40	NA	500	6.46	40
PCB 175	40186-70-7	40	NA	1000	5.63	40
PCB 176	52663-65-7	40	NA	1000	2.20	40
PCB 177	52663-70-4	40	NA	500	2.24	40
PCB 178	52663-67-9	40	NA	500	2.88	40
PCB 179	52663-64-6	40	NA	500	2.47	40
PCB 180	35065-29-3	40	NA	500	7.77	40
PCB 181	74472-47-2	40	NA	1000	5.44	40
PCB 182	60145-23-5	40	NA	1000	3.59	40
PCB 183	52663-69-1	40	NA	1000	4.27	40
PCB 184	74472-48-3	40	NA	1000	3.31	40
PCB 185	52712-05-7	40	NA	1000	4.27	40
PCB 186	74472-49-4	40	NA	1000	4.18	40
PCB 187	52663-68-0	40	NA	500	4.50	40
PCB 188	74487-85-7	40	NA	500	4.32	40
PCB 189						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	39635-31-9					
PCB 190	41411-64-7	40	NA	500	2.46	40
PCB 191	74472-50-7	40	NA	1000	3.13	40
PCB 192	74472-51-8	40	NA	1000	3.67	40
PCB 193	69782-91-8	40	NA	500	7.77	40
PCB 194	35694-08-7	40	NA	500	4.98	40
PCB 195	52663-78-2	40	NA	1000	6.21	40
PCB 196	42740-50-1	40	NA	1000	6.18	40
PCB 197	33091-17-7	40	NA	1000	5.59	40
PCB 198	68194-17-2	40	NA	500	12.97	40
PCB 199	52663-75-9	40	NA	500	12.97	40
PCB 200	52663-73-7	40	NA	1000	5.59	40
PCB 201	40186-71-8	40	NA	1000	4.29	40
PCB 202	2136-99-4	40	NA	1000	3.91	40
PCB 203	52663-76-0	40	NA	1000	4.91	40
PCB 204	74472-52-9	40	NA	1000	3.06	40
PCB 205	74472-53-0	40	NA	1000	5.50	40
PCB 206	40186-72-9	40	NA	1000	3.17	40
PCB 207	52663-79-3	40	NA	1000	2.68	40
PCB 208	52663-77-1	40	NA	1000	3.49	40
PCB 209	2051-24-3	40	NA	500	2.47	40
Monochlorobiphenyl	27323-18-8	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Dichlorobiphenyl	25512-42-9	NA	NA	NA	NA	NA
Trichlorobiphenyl	25323-68-6	NA	NA	NA	NA	NA
Tetrachlorobiphenyl	26914-33-0	NA	NA	NA	NA	NA
Pentachlorobiphenyl	25429-29-2	NA	NA	NA	NA	NA
Hexachlorobiphenyl	26601-64-9	NA	NA	NA	NA	NA
Heptachlorobiphenyl	28655-71-2	NA	NA	NA	NA	NA
Octachlorobiphenyl	55722-26-4	NA	NA	NA	NA	NA
Nonachlorobiphenyl	53742-07-7	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: TAL Metals
Concentration Level: Low

Analyte	CAS Number	Laboratory SOP[f]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
				MDLs	Method QLs	MDLs	QLs
Aluminum	7429905	C-3, C-4	2	NA	NA	0.3	2
Antimony	7440360	C-3, C-5	0.05	NA	NA	0.02	0.05
Arsenic	7440382	C-3, C-5	0.5	NA	NA	0.03	0.5
Barium	7440393	C-3, C-5	0.05	NA	NA	0.02	0.05
Beryllium	7440417	C-3, C-5	0.02	NA	NA	0.006	0.02
Cadmium	7440439	C-3, C-5	0.02	NA	NA	0.005	0.02
Calcium	7440702	C-3, C-4	4	NA	NA	2	4
Chromium	7440473	C-3, C-5	0.2	NA	NA	0.04	0.2
Cobalt	7440484	C-3, C-5	0.02	NA	NA	0.006	0.02
Copper	7440508	C-3, C-5	0.1	NA	NA	0.02	0.1
Iron	7439896	C-3, C-4	10	NA	NA	3	10
Lead	7439921	C-3, C-5	0.02	NA	NA	0.005	0.02
Magnesium	7439954	C-3, C-4	2	NA	NA	0.4	2
Manganese	7439965	C-3, C-5	0.05	NA	NA	0.006	0.05
Mercury	7439976	B-1	1	NA	NA	0.15	0.4
Nickel	7440020	C-3, C-5	0.2	NA	NA	0.03	0.2
Potassium	7440097	C-3, C-4	100	NA	NA	50	100

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Silver	7440224	C-3, C-5	0.02	NA	NA	0.004	0.02
Selenium	7782492	C-3, C-5	1	NA	NA	0.3	1
Sodium	7440235	C-3, C-4	200	NA	NA	70	200
Thallium	7440280	C-3, C-5	0.02	NA	NA	0.005	0.02
Vanadium	7440622	C-3, C-5	0.2	NA	NA	0.03	0.2
Zinc	7440666	C-3, C-5	0.5	NA	NA	0.2	0.5

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PCDD/PCDFs
Concentration Level: Low

Analyte	CAS Number	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
			MDLs	Method QLs	EDLs	QLs
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001020	50	NA	50	6.5	50
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268879	50	NA	50	7.5	50
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562394	25	NA	50	1.3	25
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822469	25	NA	50	3.1	25
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673897	25	NA	50	2	25
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648269	25	NA	50	2.1	25
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227286	25	NA	50	2.1	25
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117449	25	NA	50	0.96	25
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653857	25	NA	50	2.2	25
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918219	25	NA	50	1.6	25
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408743	25	NA	50	2.5	25
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117416	25	NA	50	1.8	25
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321764	25	NA	50	1.9	25
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851345	25	NA	50	1	25
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117314	25	NA	50	1.6	25
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207319	5	NA	10	1.2	5
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746016	5	NA	10	1.2	5

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Total Heptachlorodibenzofuran (HpCDF)	3898-75-3	50	NA	NA	NA	50
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4	50	NA	NA	NA	50
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1	50	NA	NA	NA	50
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8	50	NA	NA	NA	50
Total Pentachlorodibenzofuran (PeCDF)	60402-15-4	50	NA	NA	NA	50
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9	50	NA	NA	NA	50
Total Tetrachlorodibenzofuran (TCDF)	55722-27-5	50	NA	NA	NA	50
Total Tetrachlorodibenzo-p-dioxin (TCDD)	41903-57-5	50	NA	NA	NA	50

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: Herbicides; Method 8151; Test America, Pittsburgh, PA
Concentration Level: Low

Analyte	CAS Number	Project QL (µg/L)	Analytical Method[d]		Achievable Laboratory Limits[e]	
			MDLs µg/L	Method QLs (µg/L)	MDLs (µg/L)	QLs (µg/L)
2,4-D	94-75-7		0.110 (ECD)[f]	NA	0.000274	0.004
2,4-DB	94-82-6		NA	NA	0.000306	0.004
2,4,5-T	93-76-5		NA	NA	0.000125	0.001
2,4,5-TP (Silvex)	93-72-1		0.280 (ECD)	NA	0.000105	0.001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: General Chemistry
Concentration Level: Low

Analyte	CAS Number	Laboratory SOP[f]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
				MDLs	Method QLs	MDLs	QLs
Suspended Sediment Concentrations	NA	C-17	NA	NA	NA	1000	NA
Total Dissolved Solids	NA	C-19	5000	NA	NA	5000	5000
Total Organic Carbon	NA	C-13	300	NA	NA	30	300
Cyanide	57-12-5	C-10	0.01	NA	NA	0.003	0.01

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PAHs and alkyl PAHs by LRMS-SIM isotope dilution
Concentration Level: Low

Analyte	CAS Number	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e,g]	
			MDLs	Method QLs	MDLs	QLs
1-Methylnaphthalene	90120	10	NA	NA	4.1	10
1-Methylphenanthrene	832699	10	NA	NA	0.7	10
2,3,5-Trimethylnaphthalene	2245387	10	NA	NA	1.6	10
2,6-Dimethylnaphthalene	581420	10	NA	NA	2.2	10
2-Methylnaphthalene	91576	20	NA	NA	8.3	20
Acenaphthene	83329	10	NA	NA	2.4	10
Acenaphthylene	208968	10	NA	NA	0.15	10
Anthracene	120127	10	NA	NA	0.71	10
Fluorene	86737	10	NA	NA	1.5	10
Naphthalene	91203	50	NA	NA	16	50
Phenanthrene	85018	20	NA	NA	11	20
Benzo[a]anthracene	56553	10	NA	NA	1.5	10
Benzo[a]pyrene	50328	10	NA	NA	0.4	10
Benzo[b]fluoranthene	205992	10	NA	NA	1.5	10
Benzo[e]pyrene	192972	10	NA	NA	1.4	10
Benzo[g,h,i]perylene	191242	10	NA	NA	0.51	10
Benzo[k]fluoranthene	207089	10	NA	NA	1	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Chrysene	218019	10	NA	NA	0.22	10
Dibenzo[a,h]anthracene	53703	10	NA	NA	0.78	10
Dibenzothiophene	132650	10	NA	NA	0.69	10
Fluoranthene	206440	10	NA	NA	2.4	10
Indeno(1,2,3-cd)pyrene	193395	10	NA	NA	1	10
Perylene	198550	10	NA	NA	0.81	10
Pyrene	129000	10	NA	NA	1.7	10
C1-Benzanthracene/chrysenes	NA	10	NA	NA	10	10
C1-Dibenzothiophenes	NA	10	NA	NA	10	10
C1-Fluorenes	NA	10	NA	NA	10	10
C1-Naphthalenes	NA	10	NA	NA	10	10
C1-Phenanthrene/anthracenes	NA	10	NA	NA	10	10
C1-Pyrene/fluoranthenes	NA	10	NA	NA	10	10
C2-Benzanthracene/chrysenes	NA	10	NA	NA	10	10
C2-Dibenzothiophenes	NA	10	NA	NA	10	10
C2-Fluorenes	NA	10	NA	NA	10	10
C2-Naphthalenes	NA	10	NA	NA	10	10
C2-Phenanthrene/anthracenes	NA	10	NA	NA	10	10
C3-Benzanthracene/chrysenes	NA	10	NA	NA	10	10
C3-Dibenzothiophenes	NA	10	NA	NA	10	10
C3-Fluorenes	NA	10	NA	NA	10	10
C3-Naphthalenes						

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

	NA					
C3-Phenanthrene/anthracenes	NA	10	NA	NA	10	10
C4-Benzanthracene/chrysenes	NA	10	NA	NA	10	10
C4-Dibenzothiophenes	NA	10	NA	NA	10	10
C4-Naphthalenes	NA	10	NA	NA	10	10
C4-Phenanthrenes/anthracenes	NA	10	NA	NA	10	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: OC Pesticides
Concentration Level: Low

Analyte	CAS Number	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
			MDLs	Method QLs	EDLs	QLs
alpha-BHC	319846	0.4	NA	0.06	0.012	0.4
beta-BHC	319857	0.4	NA	0.06	0.015	0.4
delta-BHC	319868	0.4	NA	0.06	0.018	0.4
gamma-BHC (Lindane)	58899	0.4	NA	0.06	0.016	0.4
Heptachlor	76448	0.4	NA	0.03	0.011	0.4
Aldrin	309002	0.4	NA	0.09	0.036	0.4
Heptachlor epoxide	1024573	0.4	NA	0.04	0.013	0.4
Endosulfan I	959988	0.4	NA	0.1	0.066	2.0
Dieldrin	60571	0.4	NA	0.03	0.021	0.4
4,4'-DDE	72559	0.4	NA	0.03	0.080	0.4
2,4'-DDE	3424826	0.4	NA	0.03	0.062	0.4
Endrin	72208	0.4	NA	0.03	0.157	0.4
Endosulfan II	33213659	0.4	NA	0.1	0.093	0.4
4,4'-DDD	72548	0.4	NA	0.03	0.030	0.4
2,4'-DDD	53190	0.4	NA	0.03	0.029	0.4
Endosulfan sulfate	1031078	0.4	NA	0.04	0.010	0.4
4,4'-DDT	50293	0.4	NA	0.03	0.044	0.4

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

2,4'-DDT	789026	0.4	NA	0.03	0.039	0.4
Methoxychlor	72435	0.4	NA	0.03	0.012	0.4
Endrin ketone	53494705	0.4	NA	0.04	0.022	0.4
Endrin aldehyde	7421934	0.4	NA	0.04	0.037	0.4
cis-Chlordane	5103719	0.4	NA	0.03	0.021	0.4
trans-Chlordane	5103742	0.4	NA	0.05	0.023	0.4
Oxychlordane	27304138	0.4	NA	0.06	0.029	0.4
cis-Nonachlor	5103731	0.4	NA	0.03	0.029	0.4
trans-Nonachlor	3734494	0.4	NA	0.04	0.024	0.4
Hexachlorobenzene	118741	0.4	NA	0.04	0.003	0.4

[a] Project Action Limits (PALs) are based on the lower of:
[1] NJDEP (2008) Human Health Surface Water Quality Level - freshwater
[2] NJDEP (2008) Human Health Surface Water Quality Level - saline water
[3] USEPA (2009a) Ambient Water Quality Criterion for consumption of water and organisms
[4] USEPA (2009a) Ambient Water Quality Criterion for consumption of organisms
[5] USEPA (2011a) Maximum Contaminant Levels (MCLs)
[6] USEPA (2011b) Regional Screening Values (RSLs) for tap water
[7] NJDEP (2008) Chronic Aquatic Life Surface Water Quality Level - freshwater
[8] NJDEP (2008) Chronic Aquatic Life Surface Water Quality Level - saline water
[9] USEPA (2009a) Chronic Aquatic Life Ambient Water Quality Criterion - freshwater
[10] USEPA (2009a) Chronic Aquatic Life Ambient Water Quality Criterion - saltwater
[11] Tier II chronic values (Suter and Tsao, 1996)
Cited documents are presented in the AECOM 2010 Water Column Monitoring QAPP

[b] Project QLs are equivalent to the Achievable Laboratory Quantitation Limits.

[c] Analytical MDLs and QLs are those documented in validated methods.

[d] Achievable MDLs and QLs are limits that the selected laboratory can achieve when performing the specified methods (Worksheet #23 the AECOM 2010 Water Column Monitoring QAPP) with nominal sample volumes in the absence of interferences. Actual MDLs and QLs will vary based on sample specific

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

factors. QLs listed for PCBs are equivalent to the Minimum Level (ML) per reference method definitions and may not be based on the low point of calibration. EDLs for isotope dilution methods are based on average blank EDL results. The actual reporting limits for isotope dilution methods will be the sample specific EDL rather than QL. All results between the MDL (or EDL) and QL will be reported as estimated values (J qualifier). The reporting limit will be the QL for all methods except isotope dilution methods.

[e] Achievable laboratory limits that are greater than the PALs are presented in boldface text.

[f] Refer to Worksheet #23 the AECOM 2010 Water Column Monitoring QAPP for Laboratory SOPs.

[g] Note the PAHs in both the TCL SVOC and LRMS-SIM isotope dilution methods will both be reported separately.

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QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

QAPP Worksheet #16 (UFP-QAPP Manual Section 2.8.2) Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Project Status	de maximis, inc.	Monthly	Monthly	Progress report	15th of each month
Planning and Development of Study Objectives	de maximis, inc. / CH2M HILL	April 2012	June 2012	QAPP Addendum B	May 2012
Collection of Samples and Submission for Analysis	CH2M HILL/ BioGenesis/ Pear Technology	May 2012	May 2012	Sample submission to laboratories	At time of collection
Bench-scale Testing	CH2M HILL/ BioGenesis/ Pear Technology	June 2012	August 2012	Bench-scale study report	August 2012
Laboratory Analysis	CH2M HILL	June 2012	August 2012	Analytical data to CPG	Approximately 30 days after collection. See Worksheet #30 (RM 10.9 QAPP and RM 10.9 Addendum B) for turnaround times.
Preparation and Delivery of Sampling Report to USEPA	de maximis, inc. / CH2M HILL	July 2012	September 2012	Draft Bench-Testing Results Report	September 2012

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

The proposed sampling locations for the bench-scale tests proposed by BioGenesis and Pear Technology are presented in Figures 1 and 2.

Three samples from each vendor will be collected during the bench-scale testing. These include a sample of the untreated sediment, a sample of the composited treated sediment, and waste water from the holding tank. In addition, two duplicates will be collected during the BioGenesis bench-scale testing, one from the untreated sediment and one from the waste water holding tank.

Efficiency of the treatment process will be determined by comparing the analytical results of the treated and the untreated sediment samples. Additionally, suitability of the treated sediment for beneficial reuse will be determined by comparing the analytical results of the treated sediment with that of the NJDEP soil screening criteria for residential use and the dioxin criterion of 1,000 ppt TEQ. Quality of the waste water generated during the bench scale test will dictate its disposal by the vendors.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

				Solids Analyses													
Loc.	Sample ID	Sample Type	PCDDs/PCDFs	PCBs	PAHs	SVOCs	Pest.	Herb.	Butyltins	TAL Metals (excl. Hg)	Ti	Low-level Hg	TPH-Extractables	CN	TOC	Grain Size	TCLP[a]
BioGenesis																	
1	TBD	Untreated Sediment + Duplicate	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2	TBD	Treated Sediment	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pear Technology																	
1	TBD	Untreated Sediment	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2	TBD	Treated Sediment	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

[a] Treated sediment will be analyzed for toxicity characteristic leaching procedure (TCLP) SVOCs, TCLP organochlorine pesticides, TCLP chlorinated herbicides, TCLP metals, TCLP mercury and all Group A analytes listed for untreated sediment.

Key:
Loc: Sample collection location
Pest: Pesticides
Herb: Herbicides
Ti: Titanium
Hg: Mercury
CN: cyanide
TOC: Total organic carbon

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

			Aqueous Analyses												
Loc	**Sample ID**	**Sample Type**	**PCDDs/ PCDFs**	**PCBs**	**PAHs**	**VOCs**	**SVOCs**	**Pest**	**Herb**	**TAL Metals (excl Hg)**	**Low-level Hg**	**CN**	**TOC**	**TDS**	**SSC**
BioGenesis															
3	TBD	Wastewater Holding Tank + Duplicate	x	x	x	x	x	x	x	x	x	x	x	x	x
Pear Technology															
3	TBD	Wastewater Holding Tank	x	x	x	x	x	x	x	x	x	x	x	x	x

Key:
Loc: Sample collection location
Pest: Pesticides
Herb: Herbicides
Hg: Mercury
CN: Cyanide
TOC: total organic carbon
TDS: Total dissolved solids
SSC: Suspended sediment concentration

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	VOCs	Low	C-1, C-2	120 milliliter (mL)	3 x 40mL Volatile Organics Analysis (VOA) vials	4±2°Celsius (C) , hydrochloric acid (HCl) to pH <2, store in the dark	14 days for preparation and analysis
Water	SVOCs	Low	T-7, T-2	2 Liters (L)	2 x 1L amber glass with Polytetrafluoroethylene (PTFE)-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	PAHs (LRMS-SIM)	Low	T-3, T-4	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	OC Pesticides	Low	T-11, T-12	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	PCBs (Homologs and Congeners)	Low	T-5,T-6	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	365 days for preparation and analysis
Water	PCDD/PCDFs	Low	A-1	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	365 days for preparation and analysis
Water	Herbicides	Low	TA-13, TA-15	2L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	TAL Metals	Low	C-3, C-4, C-5	2 L	2 x 1L plastic[c]	Nitric acid (HNO_3) to pH<2	180 days (6 months) for preparation and analysis

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Water	Low Level Mercury	Low	B-1	500 mL	2 x 250mL PTFE with PTFE-lined lids	4±2°C during shipment; Samples must be preserved or analyzed within 48 hours of collection. Samples will be oxidized by addition of 5mL/L BrCl to original sampling container. Oxidation of the sample within the original container will extend the time to preservation to 28 days	28 days to analysis if preserved 48 hours to analysis if unpreserved
Water	Cyanide	Low	C-10	500 mL	2 x 250mL glass or plastic	4±2□ C, sodium hydroxide (NaOH) to pH > 12	14 days to analysis
Water	TOC	Low	C-13	120 mL	3 x 40mL amber glass vials with PTFE-lined lids	4±2□ C; H_2SO_4 to pH < 2	28 days to analysis
Water	SSC	Low	C-17	2 L	Two 1-L plastic	4±2°C; store in the dark; weigh entire sample bottle to nearest 0.1 g and record weight upon receipt at laboratory	28 days to analysis
Water	TDS	Low	C-19	400 mL	2 x 250mL glass or plastic	4±2°C	7 days to analysis

[a] Refer to Worksheet #23 for SOP titles and methods

[b] Sample size is the minimum requested by each laboratory to perform the requested analysis; minimum sample size requirements reflect the additional sample needed to permit re-extraction and re-analysis . Additional sample volume is needed for field QC samples (e.g., matrix spikes).

[c] High or low density polyethylene or polypropylene plastics will be acceptable.

[d] Metals to be analyzed in filtered samples are arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc.

[e] Exact sample size collected and filtered is dependent on suspended sediment concentration.

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference[a]	No. of Sampling Locations (No. of Samples)	No. of Duplicates	Total No. of Samples to Lab
Water	VOCs	Low	C-1, C-2	2 (1)	0	2
Water	SVOCs	Low	T-7, T-2	2 (1)	0	2
Water	PAHs and Alkyl PAHs - LRMS-SIM	Low	T-3, T-4	2 (1)	0	2
Water	OC Pesticides	Low	T-11, T-12	2 (1)	0	2
Water	PCBs (Homologs and Congeners)	Low	T-5, T-6	2 (1)	0	2
Water	PCDD/PCDFs	Low	A-1	2 (1)	0	2
Water	Herbicides	Low		2 (1)	0	2
Water	Cyanide	Low	C-10	2 (1)	0	2
Water	TAL Metals	Low	C-3, C-4, C-5, C-18	2 (1)	0	2
Water	Low Level Mercury	Low	B-1	2 (1)	0	2
Water	SSC	Low	C-17	2 (1)	0	2
Water	TOC	Low	C-13	2 (1)	0	2
Water	TDS	Low	C-19	2 (1)	0	2

a. Refer to Worksheet #23 for SOP title and method

QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) Project Sampling SOP References Table

The following is a list of the SOPs which are modified as described on this worksheet for the RM 10.9 QAPP Addendum. Refer to the RM 10.9 QAPP Worksheet #21 for other pertinent SOPs.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
LPR-G-06	Packaging and shipping	Bench-Scale Testing Vendors	NA	Yes	Appendix B[1]

[1] Presented in the RM 10.9 QAPP Appendix B.

QAPP Worksheet #22 (UFP-QAPP Manual Section 3.1.2.4) Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[1]
YSI	Temperature sensors are factory calibrated. Conductivity, pH, salinity are calibrated against fixed calibration solutions. Dissolved oxygen calibrated in air.	Battery checks performed every morning before use, and charged every evening after use. All probes will be kept clean of debris and membranes free of tears.	Calibrate per manufacturer's specifications (Section 2.6 of manual, provided with equipment).	Daily for functionality	Daily or recalibrate as needed	Dissolved Oxygen goal is ± 0.5 mg/L of saturation in air. pH goal is ± 0.3 with buffer solutions Conductivity goal is ±10% of standard. Salinity goal is ± 10% of standard.	Recalibrated or replaced	CH2M HILL designee	LPR-FI-05

[1]Refer to the Project Sampling SOP References table (Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP).

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

The following is a list of the SOPs which are modified as described on this worksheet for the RM 10.9 QAPP Addendum. Refer to the RM 10.9 QAPP Worksheet #23 for other pertinent SOPs.

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
C-1	EPA 8260B [d]	Volatile Organic Compounds by GC/MS, VOC 8260, Rev. 14, 11/20/2009	Definitive	Organics (VOCs Analysis)	GC/MS	Test America-Knoxville, TN	Y, Use low standard to reduce QL.
C-2	EPA 5030[d]	Purge and Trap for Aqueous Samples, VOC-5030, Rev.4, 4/3/2007	Definitive	Organics (VOCs Sample Preparation)	P&T	Test America-Knoxville, TN	N
T-2	EPA 8270C [d]	Semi-volatile Organic Analysis by GC/MS: Method(s): SW-846 8270C and EPA 625, PT-MS-001, Rev.11,11/17/2009	Definitive	Organics (SVOCs)	GC/MS	Test America-Knoxville, TN	N
T-3	EPA 3520C [d]	Extraction of Selected Semi-volatile Organic Compounds and Alkylated PAHs for Analysis by GC/MS-SIM, KNOX-OP-0023, Rev. 0, 1/12/2010	Definitive	Organics (Sample Preparation)	N/A	Test America-Knoxville, TN	Y, Cleanup by Gel Permeation Cleanup (GPC) and silica gel
C-3	EPA 3010A [d]	Metals Digestion, MET-3010A, Rev. 10, 7/12/2007	Definitive	Metals (Sample Preparation-Aqueous)	N/A	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

T-4	CARB 429[e]	Isotope Dilution Analysis of Selected Semi-volatile Organic Compounds and Alkylated PAHs by Gas Chromatography/Mass Spectrometry-Selected Ion Monitoring (GC/MS-SIM), KNOX-ID-0016, Rev. 8, 8/13/2010	Definitive	Organics (PAHs)	High Resolution Gas Chromatography, Low Resolution Mass Spectrometry via Selected Ion Monitoring (HRGC/LRMS-SIM)	Test America-Knoxville, TN	N
T-5	EPA 1668A[f]	Extraction of Polychlorinated Biphenyl (PCB) Isomers for Analysis by Isotope Dilution HRGC/HRMS, KNOX-OP-0021, Rev. 1, 2/1/2011	Definitive	Organics (Sample Preparation)	N/A	Test America-Knoxville, TN	N
T-6	EPA 1668A[f]	Analysis of Polychlorinated Biphenyl (PCB) Isomers by Isotope Dilution HRGC/HRMS, KNOX-ID-0013, Rev. 9, 1/7/2010	Definitive	Organics (PCB Congeners)	HRGC/ High Resolution Mass Spectrometry (HRMS)	Test America-Knoxville	N
T-7	EPA 3520C[d]	Extraction and Cleanup of Organic Compounds from Waters Solids, Tissues and Wipes, PT-OP-001, Rev. 13, 3/11/2011	Definitive	Organics (Sample Preparation)	N/A	Test America-Knoxville	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

T-11	EPA 1699[f]	Analysis of Organochlorine Pesticides By High Resolution Gas Chromatography/High Resolution Mass Spectrometry, WS-ID-0014, Rev. 5.3, 11/17/2010	Definitive	Organics (OC Pesticides)	HRGC/HRMS	Test America-West Sacramento, CA	Y, Deactivated silica gel cleanup (described in method) required, reference method QC criteria, rather than SOP limits, must be used to flag exceedances in the report narrative
C-4	EPA 6010C[d]	Determination of Metals and Trace Elements by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), MET-ICP, Rev. 22, 7/30/2010	Definitive	Metals	ICP/AES	CAS-Kelso, WA	N
T-12	EPA 3640A[d]	Gel Permeation Cleanup [Method 3640A], WS-OP-0012, Rev. 4, 10/5/2007	Definitive	Organics (OC Pesticides)	GPC	Test America-West Sacramento, CA	N
C-5	EPA 6020A[d]	Determination of Metals and Trace Elements by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), EPA Method 6020, MET-6020, Rev. 14, 4/10/2010	Definitive	Metals	ICP/MS	CAS-Kelso, WA	N
C-10	EPA 335.2[j]	Total Cyanides and Cyanides Amenable to Chlorination, GEN-CN, Rev. 16, 12/30/2010	Definitive	General Chemistry	Lachat Quik-Chem Analyzer	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

A-1	EPA 1613B[l]	Polychlorinated Dibenzodioxin/ Furans USEPA Methods 8290,1613, 23, 0023A, and TO-9A, AP-CM-5, Rev.15, 9/02/2010	Definitive	Organics (PCDD/PCDFs)	Isotope Dilution Mass Spectrometry	Analytical Perspectives, NC	N
A-2	EPA 1613B[l]	PCDD/Fs in Water by SPE AP-SP-E5, Rev.10, 10/12/2008	Definitive	Organics (Sample Preparation)	N/A	Analytical Perspectives, NC	N
TA13, TA-15	EPA 8151A	Gas Chromatographic Analysis Based on SW-846 Methods PITT GC-001, Rev. 16, 07/14/2010	Definitive	Organics (Herbicides)	GC with ^{63}Ni detector	Test America, Pittsburgh, PA	N
B-1	EPA 1631[l]	Procedure for EPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, BR-0006, Rev. 004e, 5/24/2010	Definitive	Metals (Total Low Level Mercury)	Cold Vapor Atomic Fluorescence (CVAFS)	Brooks Rand-Seattle, WA	N
C-13	SM 5310C[i]	Total Organic Carbon in Water, GEN-TOC, Rev. 11, 2/19/2010	Definitive	General Chemistry	TOC Analyzer (Persulfate Oxidation Method)	CAS-Kelso, WA	N
C-16	EPA 440[m]	Sample Preparation for Particulate Carbon and Nitrogen and Particulate Organic Carbon in Water by Combustion / Thermo-Conductivity or Infrared Detection, GEN-PC PN POC PREP, Rev. 01, 7/3/09	Definitive	General Chemistry	TOC Analyzer	CAS-Tucson, AZ	N, note the nominal pore size of the GF/F filter used must be 0.7 um.

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

C-17	ASTM D 3977[k]	Standard Test Methods for Determining Sediment Concentration in Water Samples, GEN-3977, Rev. 0, 7/11/2011	Definitive	General Chemistry	Gravimetric	CAS-Kelso, WA	N, Note Test Option B without the 14 day settling time will be used. The nominal pore size of the GF/F filter used must be 0.7 um.
C-19	SM 2540C[i]	Solids, Total Dissolved (TDS), GEN-TDS, Rev. 8, 3/19/2010	Definitive	General Chemistry	Gravimetric	CAS-Kelso, WA	N

[a] All SOPs are contained in Appendix C-1of the AECOM 2010 Water Column Monitoring QAPP.

[b] Complete references are provided in Attachment 1 of the AECOM 2010 Water Column Monitoring QAPP.

[c] It is expected that the procedures outlined in these SOPs will be followed. Procedural modifications to individual SOPs may be warranted depending upon an individual sample matrix, interferences encountered, or limitations imposed by the procedure. Deviations from individual SOPs will be documented in the laboratory records. Substantive modification to any SOP will be approved in advance by the Project QA Manager and CWCM Task Manager and communicated to the CPG Coordinator and to the USEPA Remedial Project Manager for pre-approval before implementation. Examples of substantive modifications include changes to QA/QC requirements or control limits, changes other than required dilutions that affect sensitivity, and any changes that adversely affect the selectivity of the analyte detection. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity. Note the laboratory SOPs may contain default control limits, which are superseded by statistically derived control limits. If current statistically derived QC control limits are available; these current QC control limits are presented in Worksheet #12 and Worksheet #28 in place of the default limits presented in the SOPs, or presented in Attachment C-2 and incorporated by reference. Note laboratory updates to statistical control limits may occur during program execution.

[d] USEPA 2008a

[e] CARB 1997

[f] USEPA 2010b

[h] Krone,C.A. *et al* 1988

[l] APHA 1998

[j] USEPA 1983

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

[k] ASTM 2010

[l] USEPA 2010a

[m] USEPA 1997

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference [a]
GC/MS (VOC)	Bromofluorobenzene (BFB) tune; Initial and Continuing Calibration as Required in SOP	Verify tuning every 12 hours; initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met.	Initial calibration (ICAL) % RSD ≤30% for Calibration Check Compound (CCCs); ICAL % RSD ≤15% or linear curve r≥ 0.995, or quadratic curve $r^2 \geq 0.990$. Initial Calibration Verification (ICV) and Continuing calibration verification (CCV) percent deviation (%D) ≤20% for CCCs; system performance check compounds (SPCC) minimum average Response factors (RF).	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-1
GC/MS (SVOC)	Decafluorotriphenylphosphine (DFTPP) tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours; Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met.	ICAL %RSD ≤30% for CCCs; ICAL %RSD ≤15% or linear curve r ≥ 0.995, or quadratic curve $r^2 \geq 0.990$. CCV %D ≤20% for CCCs; SPCC minimum avg. RF is 0.050	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-2

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

HRGC/LRMS-SIM (PAH and Alkyl PAHs)	DFTPP tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours using perfluorotributylamine; Initial calibration after instrument set up, after major maintenance, and/or instrument changes have occurred	ICAL %RSD ≤30% CCV %D ≤30%. ICV %D ≤30%.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-4
HRGC/HRMS (OC Pesticides)	Instrument tuning, initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major maintenance and/or instrument changes have occurred. Calibration verification minimum every 12 hours	RSD for mean relative response factors (RRF) calibrated by isotope dilution ≤ 20%; all other compounds ≤ 30%; initial calibration verification (ICV) ≤ 30% of true value. Refer to Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP for internal precision recovery (IPR) and calibration verification (VER) criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-11

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

HRGC/HRMS (PCB Congeners and Homologs)	Retention time calibration, initial calibration, continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification minimum every 12 hours	ICAL %RSD ≤ 20% for target analytes calculated by isotope dilution. ICV %D < 50% for all targets and <35% for all but 4 target analytes %RSD ≤ 35% for target analytes calculated by internal standard. CCV ≤ 30% Drift for Toxics and LOC congeners CCV 40-160% for non-Toxic congeners. Refer to Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP for IPR and VER criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-6
Isotope Dilution Mass Spectrometry (PCDD/PCDFs)	Perfluorokerosene (PFK) Tune; initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Continuing calibration minimum every 12 hours	%RSD for mean response of unlabeled standards ≤ 10%; labeled reference compounds ± 20% Continuing calibration using Batch Control Spike (BCS_3) per SOP. Refer to Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP for IPR criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	A-1

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

GC (Herbicides)	Instrument tuning, initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major maintenance and/or instrument changes have occurred. Calibration verification minimum every 12 hours	RSD for mean relative response factors (RRF) calibrated by isotope dilution ≤ 20%; all other compounds ≤ 30%; initial calibration verification (ICV) ≤ 30% of true value. Refer to Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP for internal precision recovery (IPR) and calibration verification (VER) criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	TA-13, TA-15
ICP/AES (Metals)	Initial and continuing calibration per SOP	Profile instrument; Copper/Manganese (Cu/Mn) ratio daily; blank, RL and high standard daily; Interference Check Sample (ICS) at start and every 8 hours; Continuous calibration check (CCB), CCV every 10 samples	Cu/Mn ratio within 20% of value at time inter-element corrections (IECs) determined. ICV, CCV ± 10% of true value; ICSAB ± 20% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-4
ICP/MS (Metals)	Initial and continuing calibration per SOP	Intensity check, Cu/Mn ratio ; blank, RL and high standard daily; ICS at start and every 8 hours; CCB, CCV every 10 samples	Cu/Mn ratio within 20% of value at time IECs determined. ICV, CCV ± 10% of true value; ICSAB ± 20% of true value; mass spectrometer tuning criteria per SOP C-5	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-5

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

CVAFS (Mercury)	Initial and continuing calibration per SOP	Calibrate daily with a calibration blanks (CB) (1 per split bottle/bubbler used), minimum of 5 standards, and ICV daily. Analyze CCV every 10 samples. Analyze carryover blank following any result ≥20,000 pg.	CB: each ≤40 pg; average ≤20 pg; standard deviation ≤7.5 pg ICV 85 -115% CCV 77-123% (total mercury) Carryover blank: ≤40 pg and within ± 20 pg of average CB	Inspect system, correct problem, rerun calibration and affected samples	Analyst	B-1
Automated Ion Rapid Flow Analyzer (Cyanide)	Initial and continuing calibration per SOP	Determine Linear Calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r > 0.995; CCB, CCV every 10 samples	Linearity check must be within ± 10% of original values; ICV, CCV ± 10% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-10
TOC Analyzer	Initial and continuing calibration per SOP	CCV each batch	ICAL linearity $r^2 \geq 0.995$ ICV +/- 10% true value CCV+/- 10% true value.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-13, C-16
Analytical Balance (TDS, SSC)	Daily	Weigh and record National Institute of Standards and Technology (NIST) traceable standard weights in range of interest	± 5% of certified weight	Inspect system, correct problem, recalibrate	Analyst	C-17, C19

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix C of the AECOM 2010 Water Column Monitoring QAPP.

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
GC/MS (VOC and SVOC)	Clean sources and quadrupole rods; maintain vacuum pumps; tune mass spectrometer as needed	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	C-1, T-2
HRGC/LRMS-SIM (PAH and Alkyl PAHs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-4
HRGC/HRMS (OC Pesticides)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-11
HRGC/HRMS (PCB Congeners and Homologs)	Clean sources; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-6
Isotope Dilution Mass Spectrometry (PCDD/PCDFs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	A-1

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

GC/ECD (Herbicides)	Change septa, clean injectors, change or trim columns, install new liners; replace purifier as needed; clean autosampler periodically	Detector signals and chromatogram review	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	TA-13, TA-15
ICP/AES (Metals)	Replace disposables, flush lines	Cu/Mn ratio	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-4
ICP/MS (Metals)	Replace disposables, flush lines	Cu/Mn ratio	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-5
CVAFS (Mercury)	Replace disposables, flush lines	Sensitivity check	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	B-1, B-2
Automated Ion Analyzer (Cyanide)	Replace disposables, flush lines	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-10
TOC Analyzer (TOC)	Replace disposables, clean quartz boat; oven thermometer calibration quarterly	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-13, C-16
Analytical Balance (TDS, SSC)	Clean balance after each use; service annually	NIST Traceable weights	Instrument performance	Daily or as needed	Measured weight within certified tolerance	Clean, verify zero on balance, reweigh; call for service	Analyst or Section Supervisor	C-17, C-19

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix C of the AECOM 2010 Water Column Monitoring QAPP.

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Sample Identification

Samples will be uniquely identified at the time of collection. The sample ID will be as indicated in Worksheet #18.

Sample Packaging and Shipping Requirements

Sample custody must be maintained through shipment of samples to the contracted laboratory. Samples for chemical and physical analysis will be delivered directly to the laboratory by sampling personnel or will be shipped using the procedures outlined in SOP LPR-G-6 (Appendix B of the RM 10.9 QAPP).

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	VOCs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-1, C-2
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB/Instrument Blank	1/Prep Batch (≤20 samples)	No target compounds >QL; no common lab contaminants >5x QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL.
Trip Blank	1 per cooler of VOC samples	No target compounds >QL; no common lab contaminants >5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL
Surrogates	Every sample	1,2-Dichloroethane-d4: 59-127%R 4-Bromofluorobenzene: 68- 17%R Dibromofluoromethane: 73- 22%R Toluene-d8: 78-129%R	Check calculations and instrument performance; recalculate, reanalyze	Analyst/Section Supervisor	Accuracy/Bias	1,2-Dichloroethane-d4: 59-127%R 4-Bromofluorobenzene: 68-117%R Dibromofluoromethane: 73-122%R Toluene-d8: 78-129%R
LCS	1/Prep Batch (≤20 samples)	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	SVOCs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-2, T-7
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL; no common lab contaminants >5x QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed. Report results if sample results >20x blank result or sample results not detected (ND).	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Surrogates	Every sample	2-Fluorobiphenyl: 19-107%R 2-Fluorophenol: 10-111%R 2,4,6-Tribromophenol: 16-122%R Nitrobenzene-d5: 23-112%R Phenol-d5: 15-112%R Terphenyl-d14: 10-132%R	Check calculations and instrument performance; recalculate, reanalyze	Analyst/Section Supervisor	Accuracy/Bias	2-Fluorobiphenyl: 19-107%R 2-Fluorophenol: 10-111%R 2,4,6-Tribromophenol: 16-122%R Nitrobenzene-d5: 23-112%R Phenol-d5: 15-112%R Terphenyl-d14: 10-132%R
LCS	1/Prep Batch (≤20 samples)	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PAHs and Alkyl PAHs (LRMS-SIM)
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-4, T-3
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Labeled Compounds	Every sample	60-140%R in MB & LCS 30-120%R in field samples	Check calculations. Ensure that instrument performance is acceptable. If signal/noise (S/N) ratio <10, re-prepare and reanalyze sample. If S/N ratio >10, flag data	Analyst/Section Supervisor	Accuracy/Bias	60-140%R in MB & LCS 30-120%R in field samples
LCS	1/Prep Batch (≤20 samples)	60-140%R	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	60-140%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	OC Pesticides
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-11
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL.	1) Report results if sample results >10x blank result or sample results ND. 2) If results are <20x blank and if sufficient sample is available, re-extract and reanalyze samples. 3) If insufficient sample is available, reanalyze extracts. 4) Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

OPR Sample (equivalent to LCS)	1/Prep Batch (<20 samples)	50-120%R, except for 4,4'-DDD 24-123%; 2,4'-DDE 24-123%; Endrin Aldehyde 50-170%; Endrin Ketone 50-134%	1) Check calculations. 2) Reanalyze LCS. Repeated reanalysis is acceptable if the failure is attributed to instrument variability. 3) If repeated failures occur on consecutive LCSs for the same analyte, the cause of the failure will be investigated and corrected before any re-extraction is performed. 4) If sufficient sample is available, re-extract and reanalyze samples. 5) If insufficient sample is available, reanalyze extracts. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	50-120%R, except for 4,4'-DDD 24-123%; 2,4'-DDE 24-123%; Endrin Aldehyde 50-170%; Endrin Ketone 50-134%;

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Labeled Compounds	Spiked into every sample and QC sample	Per EPA 1699 Table 5	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveals a problem. If S/N <10 for quantitation ion, reprepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	Per EPA 1699 Table 5
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PCBs – Congeners and Homologs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-6
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compounds >QL
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
OPR Sample (equivalent to LCS)	1/Batch (20 samples)	50-150%R Toxics/LOC congeners; 40-160%R all other congeners	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias	50-150%R Toxics/LOC congeners; 40-160%R all other congeners

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Labeled Compounds	Spiked into every sample and QC sample.	30-140%R	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveal problem. If S/N<10 for the quantitation ion, re-prepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	30-140%R
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PCDD/PCDFs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	A-1
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Analytical Perspectives
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Labeled Compounds	Spiked into every sample and QC sample.	See reference method and SOP for compound specific control limits	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveal a problem. If S/N<10 for quantitation ion, re-prepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	See reference method and SOP for compound specific control limits
BCS_3	1/Batch (20 samples)	%D for RRF vs ICAL $\leq$ 20% except labeled analogs $\leq$ 30%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	%D for RRF vs ICAL $\leq$ 20% except labeled analogs $\leq$ 30%

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group	Herbicides (GC/ECD)
Concentration Level	Low
Sampling SOP	LPR-FI-04
Analytical Method/ SOP Reference	TA-13, TA-15
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Test America
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Method Blank - 1/Batch (20 samples);	No Target Compounds>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Compounds>QL
LCS	1/Batch (20 samples)	See Laboratory % RCLs (Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	RCLs (Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	CH2M HILL Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	TAL Metals: ICP/AES
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	C-4, C-3
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	CAS
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compounds >QL
LCS	1/Batch (20 samples)	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 20%
Field Duplicate	1/20 field samples	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	TAL Metals: ICP/MS
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	C-5, C-3, C-6
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	CAS
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Contamination	No target compounds >QL
LCS	1/Batch (20 samples)	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2 of the AECOM 2010 Water Column Monitoring QAPP
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals: Mercury -Low Level
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	B-1
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	Brooks Rand, LLC
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	3/Batch (20 samples)	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples
LCS	1/batch	80 -120%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	80 -120%R
CRM	1/Batch (10 samples)	Within 25% of certified value	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Within 25% of certified value
Laboratory Duplicate	1/Batch (10 samples)	RPD $\leq$24%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD $\leq$24%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	SSC
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-17
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	CAS
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry - Cyanide
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[b]	C-10
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	CAS
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	83-116%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	83-116%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – TDS
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-19
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	CAS
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	85-115%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	85-115%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤10%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤10%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – TOC
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-13, C-16
Sampler's Name	CH2M HILL Field Staff
Field Sampling Organization	CH2M HILL
Analytical Organization	CAS
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	<QL
LCS	1/Batch (20 samples)	95-105%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	95-105%R
LCSD	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Inorganic Carbon Spike	1/Batch (20 samples)	≤110% of the unspiked sample	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	≤110% of the unspiked sample
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 of the AECOM 2010 Water Column Monitoring QAPP for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21 of the AECOM 2010 Water Column Monitoring QAPP
[c] Refer to QAPP Worksheet #23 of the AECOM 2010 Water Column Monitoring QAPP

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization	Backup Laboratory/ Organization
Water	VOCs	Low	All	C-1	30 days	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Water	SVOCs	Low	All	T-2	30 days	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Water	PAHs –LRMS SIM	Low	All	T-4	45 days	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Water	OC Pesticides	Low	All	T-11	45 days	Test America 880 Riverside Parkway West Sacramento, CA 95605 Robert Weidenfeld 865.291.3000	Vista Analytical Laboratory 1104 Windfield Way El Dorado Hills, CA 95762 Martha Maier 916.673.1520
Water	Chlorinated Herbicides	Low	All	TA-13, TA-15	45 days	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058	Vista Analytical Laboratory 1104 Windfield Way El Dorado Hills, CA 95762 Martha Maier 916.673.1520

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Water	PCBs (Homologs and Congeners)	Low	All	T-6	45 days	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	Analytical Perspectives 2714 Exchange Dr. Wilmington, NC 28405 Bryan Vining 910.794.1613 bryan.vining@sgs.com Phillip Hanna phillip.hanna@sgs.com
Water	TAL Metals (excluding mercury)	Low	All	C-4, C-5	30 days	CAS1317 South 13th Ave.Kelso, WA 98626 Lynda Huckestein 360.577.7222	Brooks Rand, LLC3958 6th Ave. NWSeattle, WA 98107 Misty Kennard-Mayer 206.632.6206
Water	Low Level Mercury	Low	All	B-1	30 days	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206.632.6206 Elizabeth Madonick elizabeth@brooksrand.com Michelle Briscoe michelle@brooksrand.com	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Water	TOC	Low	All	C-13	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	Cyanide	Low	All	C-10	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Water	TDS	Low	All	C-19	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	SSC	Low	All	C-17	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 30 Community Drive, Suite 11 South Burlington, VT 05403 Kris Dusablon 865.291.3000
Water	PCDD/PCDFs	Low	All	A-1	45 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Todd Vilen 910-794-1613	Test America 880 Riverside Parkway West Sacramento, CA 95605 David Alltucker 916.374.4334

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Mark Stinnett, Project Chemist/ CH2M HILL
IIa	Analytical data deliverables, contractual documents	Verify the required deliverables, analyte lists, method holding times, analytical procedures, laboratory qualifiers, measurement criteria, and project quantitation limits conform to specifications. Verify that deviations from procedures or criteria were documented.	Mark Stinnett, Project Chemist/ CH2M HILL
IIa	Field records, database output	Verify transcription of field data from field forms to database.	Mark Kill, Data Management Task Manager/ddms
IIa	Custody records, analytical data reports	Review traceability from sample collection through reporting.	Mark Stinnett, Project Chemist/ CH2M HILL
IIa	Laboratory EDDs, analytical data reports, database output	Verify EDDs against hard-copy analytical reports.	Mark Kill, Data Management Task Manager/ddms
IIa	Data validation reports, database output	Verify that entry of qualifiers was correct and complete.	Mark Kill, Data Management Task Manager/ddms
IIb	Analytical data reports	Verify that reported analytes, holding times, analytical procedures, measurement criteria, and project quantitation limits conform to the QAPP. Verify that deviations from procedures or criteria were documented.	Mark Stinnett, Project Chemist/ CH2M HILL
IIb	Analytical data reports, validation guidance	One hundred percent of the data will be validated (see details below).	Mark Stinnett, Project Chemist/ CH2M HILL
IIb	QAPP, analytical data reports,	Verify that the qualifiers applied during validation were in conformance with	Mark Stinnett, Project Chemist/

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

	validation guidance		
IIb	Analytical data reports	Verify that PE samples were analyzed at the frequency specified in the QAPP and met the acceptance criteria.	Not Applicable to QAPP Addendum B
IIb	QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Mark Stinnett, Project Chemist/ CH2M HILL

Data Validation

Validation of each analytical group will be limited to the target analytes listed in Worksheet #15 for that group. At a minimum, 100% full validation (includes review of raw data and spot check for verification of calculations) will be conducted for PCDD/PCDFs (the 2,3,7,8-substituted Congeners and Homologs listed in Worksheet #15), all 209 PCB Congeners and Homologs, OC Pesticides, PAHs and Alkyl PAHs, mercury and methyl mercury for each sample delivery group (SDG). For all other parameters, 100% full validation (as appropriate to the analyses) will be performed on the first SDG. The remaining SDGs will be subject to full validation for every fifth SDG, and limited validation for the remaining SDGs.

Limited validation will be based on information provided by the laboratory on their QC forms, and will include no or minimal raw data review. At a minimum, limited validation will include the following data elements:

- Agreement of analyses conducted with COC requests
- Holding times and sample preservation
- Initial and continuing calibrations and analytical sequence
- Mass spectrometer tuning (GC/MS only)
- Internal standard performance (GC/MS only)
- Laboratory blanks/equipment blanks/ field blanks/ trip blanks
- Surrogate recoveries
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Interference check sample (ICS) results (AB solution only)
- Inductively Coupled Plasma (ICP) serial dilution results
- Chemical yield (tracers and carriers) (radiochemical only)
- Percent solids
- Quantitation limits and sample results (limited to evaluating dilutions and reanalyses)

If significant issues (e.g., those affecting achievement of the DQOs) are noted during full validation, the limited validation will be expanded to include this issue. Systematic or random errors that would not be detected during a review of the summary forms might include, for example, misidentification or quantitation of compounds, transcription errors, or calculation errors. In addition, limited validation will provide review of key laboratory QC elements, which would highlight potential underlying lab issues which may require further investigation (i.e., full validation effort). If a high frequency of measurement performance issues are found, the issue will be investigated and an additional validation effort may be implemented. AECOM plans to maintain communication/notification systems with the laboratory during the analytical process to circumvent significant QC issues. If QC issues do arise, investigations and corrective actions will be documented and implemented in a timely fashion to optimize the amount of un-qualified data.

In addition, data packages receiving limited validation will receive a completeness check so that full validation could be performed at a later data, if necessary. The check will verify that the raw data for each sample (including all reanalyses and dilutions) are present and complete. The data supporting the sample results, such as QC samples (method blanks, LCS, MS/MSD), calibrations, tunes, and preparation logs, will also be reviewed for overall completeness, however, an in-depth inventory to ensure specific association with all sample data will not be performed.

No additional completeness check will be performed for the geotechnical tests due to limited back-up information provided and the nature of the tests.

Validation qualifiers will be applied based on the criteria in the QAPP, method-specific Region II validation SOPs, or professional judgment. These will be limited to “J”, “UJ”, “K”, and “NJ”, as defined in the Region II validation SOPs.

Reports summarizing data qualification as a result of the validation effort will be prepared.

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
CH2M HILL's data validation subcontractor will validate all laboratory data in accordance with the process and protocols described in Worksheet #35 of this document and Worksheet #36 of the RM 10.9 QAPP. The Project QA Manager, in conjunction with the project team, will determine whether the analytical data meet the requirements for use in making decisions related to further actions at the site. The results of laboratory measurements will be compared to the DQOs described in Worksheet #11 of this document.

Describe the evaluative procedures used to assess overall measurement error associated with the project:
During the data validation process the validator will use information confirming sample identification; sample preparation; analysis within holding time; instrument calibration data; and results of QC samples designed to assess blank contamination, analytical precision, and accuracy to identify any limitations in data use and, if known, data bias. The validator will apply qualifiers as needed to reflect any limitations on the use of specific data points and prepare a report detailing the information reviewed, data limitations, and overall usability. Patterns of data use limitations or anomalies which become apparent during the validation process or as the users will be reviewed with the Project QA Manager and the appropriate laboratory. Data that do not meet the quality acceptance limits of Worksheet #28, or quality levels of Worksheet #15, or analytical performance criteria specified in Worksheet #12 will be clearly identified in the database so data users are aware of any limitations associated with data usability. Details of the problems identified during data validation and the bias in the data will be provided in the associated validation memorandum.

Identify the personnel responsible for performing the usability assessment:
Data validation will be performed by CH2M HILL's data validation subcontractor. The usability assessment will be performed jointly by the CH2M HILL and CPG project teams and will include input by field personnel, QA staff, and project management.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:
The documentation generated during data validation will include a comprehensive memorandum that describes the information reviewed, the results of this review and provides a recommendation on overall data usability and limitations on specific data points. The memorandum and associated validation worksheets provide information on the samples included in the review and the date they were collected; the condition of samples when received at the laboratory and any discrepancies noted during the receiving process; verification of sample preparation and analysis within the method specified holding time; instrument calibration information; review of associated QC analyses including blanks, LCS, and field and/or laboratory duplicates; verification of selected reported values from raw data. As a result of this review standard qualifiers are entered into the database so that data users can readily identify any limitations associated with a specific data point.

Appendix A
Field Standard Operating Procedures